Workshop organizers make last-minute changes to their schedule. Download this document again to get the latest changes, or use the NIPS mobile application.

Schedule Highlights

Dec. 7, 2018

NIPS 2018 Competition Track Day 1 Escalera, Herbrich
Critiquing and Correcting Trends in Machine Learning Rainforth, Kusner, Bloem-Reddy, Paige, Caruana, Teh
Smooth Games Optimization and Machine Learning Lacoste-Julien, Mitliagkas, Gidel, Syrgkanis, Tardos, Bottou, Nowozin
Deep Reinforcement Learning Abbeel, Silver, Singh, Pineau, Achiam, Houchoot, Srinivas
All of Bayesian Nonparametrics (Especially the Useful Bits) Cai, Campbell, Hughes, Broderick, Foti, Williamson
Continual Learning Pascanu, Teh, Pickett, Ring
2nd Workshop on Machine Learning on the Phone and other Consumer Devices (MLPCD 2) Ravi, Chai, Jia, Aradhye, Jain
Bayesian Deep Learning Gal, Hernández-Lobato, Louizos, Wilson, Ghahramani, Murphy, Welling
Modeling the Physical World: Learning, Perception, and Control Wu, Allen, Smith, Hamrick, Dupoux, Toussaint, Tenenbaum
Causal Learning Anovskiy, Heinze-Deml, Klimovskaia, Oquab, Bottou, Lopez-Paz
Visually grounded interaction and language Strub, de Vries, Wijmans, Datta, Perez, Malinowski, Lee, Anderson, Courville, MARY, Batra, Panik, Pietquin, HORI, Marks, Cherian
MLsys: Workshop on Systems for ML and Open Source Software Lakshmiratan, Bird, Sen, Gonzalez, Crankshaw
NIPS 2018 workshop on Compact and interoperable Deep Neural Networks with industrial applications Fan, Lin, Welling, Chen, Bailier
Imitation Learning and its Challenges in Robotics Mukadam, Choudhury, Srinivas
Workshop on Security in Machine Learning Papernot, Steinhardt, Fredrikson, Chaudhuri, Tramer
Workshop on Social, Political, and Ethical Issues in AI Bakalar, Bird, Caetano, Felten, Garcia, Kloumann, Lattimore, Mullainathan, Sculley
The second Conversational AI workshop – today’s practice and tomorrow’s potential Geramifard, Williams, Heck, Glass, Gasic, Hakkani-Tur, Young, Polynetakis, Bourou, Eskenazi
Machine Learning for Geophysical & Geochemical Signals Pyrak-Nolte, Rustad, Baraniuk
Challenges and Opportunities for AI in Financial Services: the Impact of Fairness, Explainability, Accuracy, and Privacy Veloso, Kallus, Shah, Kumar, Moulinier, Chen, Paisley
Modeling and decision-making in the spatiotemporal domain Senanayak, Jean, Ramos, Chowdhary

Dec. 8, 2018

NIPS 2018 Competition Track Day 2 Herbrich, Escalera

Wordplay: Reinforcement and Language Learning in Text-based Games Trischler, Lazaridou, Bisk, Tay, Kushner, Côté, Sordoni, Ricks, Zahavy, Daumé III
Reinforcement Learning under Partial Observability Pajarinen, Amato, Poupart, Hsu
Privacy Preserving Machine Learning Bellet, Gascon, Kilbertus, Ohrimenko, Raykova, Weller
AI for social good Luck, Sylvain, Cohen, Farsi Tchango, Goddard, Helouis, Bengio, Greydanus, Wild, Kucnerenko, Farahi, Penn, McGregor, Crowley, Gupta, Chen, Côté
Learning by Instruction Srivastava, Labutov, Yang, Azaria, Mitchell
NIPS 2018 Workshop on Meta-Learning Grant, Hutter, Ravi, Vanschoren, Wang
Integration of Deep Learning Theories Baraniuk, Anandkumar, Mallat, Patel, H.
Machine Learning for Health (ML4H): Moving beyond supervised learning in healthcare Beam, Naumann, Ghassemi, McDermott, Fiterau, Chen, Beaulieu-Jones, Hughes, Shamout, Chivers, Kandola, Yali, Finlayson, Jedynak, Schulam, Antropova, Fries
Machine Learning for Systems Goldie, Mirhoeseini, Raiman, Swersky, Hashemi
NIPS Workshop on Machine Learning for Intelligent Transportation Systems 2018 Li, Dragan, Niebles, Savarese
Machine Learning for Molecules and Materials Hernández-Lobato, Müller, Paige, Kusner, Chmiela, Schütt
Relational Representation Learning Grover, Varma, Sala, Holtzen, Nevile, Ermon, Ré
CIML 2018 - Machine Learning competitions "in the wild": Playing in the real world or in real time Guyon, Viegas, Escalera, Abernethy
Infer to Control: Probabilistic Reinforcement Learning and Structured Control Kaelbling, Riedmiller, Toussaint, Mordatch, Fox, Haarnoja
Emergent Communication Workshop Foerster, Lazaridou, Lowe, Mordatch, Keia, Cho
Interpretability and Robustness in Audio, Speech, and Language Ravanelli, Serdyuk, Variani, Ramabhadran
Machine Learning Open Source Software 2018: Sustainable communities Strathmann, Gal, Curtin, Lisitsyn, Honkela, Ong
Second Workshop on Machine Learning for Creativity and Design Elliott, Dieleman, Fiebrink, Engel, Roberts, White
Medical Imaging meets NIPS Konukoglu, Glocker, Lombaert, de Bruijine
NIPS 2018 Workshop book

Dec. 7, 2018

NIPS 2018 Competition Track Day 1

Sergio Escalera, Ralf Herbrich

Fri Dec 07, 08:00 AM

coming soon.

Critiquing and Correcting Trends in Machine Learning

Tom Rainforth, Matt Kusner, Ben Bloem-Reddy, Brooks Paige, Rich Caruana, Yee Whye Teh

Fri Dec 07, 08:00 AM

Machine learning has become wildly successful in many application areas. Recently there have been calls for making machine learning more reproducible, less hand-tailored, fair, and generally more thoughtful about how research is conducted and put into practice. These are hallmarks of a mature scientific field, and will be crucial for machine learning to have the wide-ranging, positive impact it is expected to have. Without careful consideration, we as a field risk inflating expectations beyond what is possible. To address this, this workshop aims to better understand and to improve all stages of the research process in machine learning.

There have been a number of recent works that have carefully considered current trends in machine learning as well as the needs of the field when used in real-world scenarios [1-16]. Each of these works introspectively analyzes what we often take for granted as a field. Further, many propose solutions for moving forward. The goal of this workshop is to bring together researchers from all subfields of machine learning to address current shortcomings in the field, and crucially, to propose solutions. We hope to highlight issues and propose solutions in areas such as:

- Common experimental practices [1, 8]
- Implicit technical and empirical assumptions that go unquestioned [2, 3, 5, 7, 11, 12, 13]
- Shortfalls in publication and reviewing setups [15, 16]
- Disconnects between research focus and application requirements [9, 10, 14]
- Surprising observations that make us rethink our research priorities [4, 6]

In a highly interactive format, we will outline the current challenges and ways forward. The program is a collection of invited talks, alongside contributed posters and talks. For these talks, we plan a unique open format of 10 minutes of talk + 10 minutes of follow up discussion. Additionally, a separate panel discussion will collect researchers with a diverse set of viewpoints on the current challenges and potential solutions. During the panel we will also open the conversation to the audience. The discussion will further be open to an online Q&A which will be solicited prior to the workshop. An expected outcome of this workshop is a list of open problems and problematic trends at all levels of machine learning research, and some possible solutions.

Call for Papers:

The NIPS 2018 Workshop: Critiquing and Correcting Trends in Machine Learning calls for papers that critically examine current common practices and/or trends in methodology, datasets, empirical standards, publication models, or any other aspect of machine learning research. In particular, we seek constructive papers, which propose a solution or indicate a way forward. Examples of such papers include (but are not limited to):

- Papers that argue for broad structural changes, such as: reviewer guidelines and standards; the field’s emphasis on short research reports; the conference publication model; standards for code and result reproducibility.
- Proposition papers that outline important and long term challenges in specific subfields.
- Papers that define desirable operating characteristics for machine learning algorithms in real-world application settings.
- Papers that propose to eliminate or replace particular methodological norms. For example, papers which question common implicit assumptions or experimental practices.

Papers should motivate their arguments by describing gaps in the field. Crucially, this is not a venue for settling scores or character attacks, but for moving machine learning forward as a scientific discipline.

The workshop will include a poster session, giving the opportunity to present novel ideas and ongoing projects. Submissions should be 2-4 pages in the NIPS format. Please email all submissions to: nips2018.guidelines.workshop@gmail.com

Deadline: October 18th, 2018, 11:59 UTC

References

[7] Urban, G., Geras, K. J., Kahou, S. E., Wang, O. A. S., Caruana, R., Mohamed, A., ... & Richardson, M. (2016). Do deep convolutional nets really need to be deep (or even convolutional?).

Two-player smooth games. For example, the Jacobian of gradient descent on such games are distinct from the better understood dynamics of electricity. Test-of-time award presentation, NIPS.

Deep Reinforcement Learning

Pieter Abbeel, David Silver, Satinder Singh, Joelle Pineau, Joshua Achiam, Rein Houthooft, Aravind Srinivas

Fri Dec 07, 08:00 AM

In recent years, the use of deep neural networks as function approximators has enabled researchers to extend reinforcement learning techniques to solve increasingly complex control tasks. The emerging field of deep reinforcement learning has led to remarkable empirical results in rich and varied domains like robotics, strategy games, and multitagent interaction. This workshop will bring together researchers working at the intersection of deep learning and reinforcement learning, and it will help interested researchers outside of the field gain a high-level view about the current state of the art and potential directions for future contributions.

All of Bayesian Nonparametrics (Especially the Useful Bits)

Diana Cai, Trevor Campbell, Mike Hughes, Tamara Broderick, Nick Foti, Sinead A Williamson

Fri Dec 07, 08:00 AM

Bayesian nonparametric (BNP) methods are well suited to the large data sets that arise in a wide variety of applied fields. By making use of infinite-dimensional mathematical structures, BNP methods allow the complexity of a learned model to grow as the size of a data set grows, exhibiting desirable Bayesian regularization properties for small data sets and allowing the practitioner to learn ever more from larger data sets. These properties have resulted in the adoption of BNP methods across a diverse set of application areas—including, but not limited to, biology, neuroscience, the humanities, social sciences, economics, and finance.

This workshop aims to highlight recent advances in modeling and computation through the lens of applied, domain-driven problems that require the infinite flexibility and interpretability of BNP. In this workshop, we will explore new BNP methods for diverse applied problems, including cutting-edge models being developed by application domain experts. We
Continual learning (CL) is the ability of a model to learn continually from a stream of data, building on what was learnt previously, hence exhibiting positive transfer, as well as being able to remember previously seen tasks. CL is a fundamental step towards artificial intelligence, as it allows the agent to adapt to a continuously changing environment, a hallmark of natural intelligence. It also has implications for supervised or unsupervised learning. For example, when the dataset is not properly shuffled or there exists a drift in the input distribution, the model overfits the recently seen data, forgetting the rest -- phenomena referred to as catastrophic forgetting, which is part of CL and is something CL systems aim to address. Continual learning is defined in practice through a series of desiderata. A non-complete lists includes: * Online learning -- learning occurs at every moment, with no fixed tasks or data sets and no clear boundaries between tasks; * Presence of transfer (forward/backward) -- the model should be able to transfer from previously seen data or tasks to new ones, as well as possibly new task should help improve performance on older ones; * Resistance to catastrophic forgetting -- new learning does not destroy performance on previously seen data; * Bounded system size -- the model capacity should be fixed, forcing the system use its capacity intelligently as well as gracefully forgetting information such to ensure maximising future reward; * No direct access to previous experience -- while the model can remember a limited amount of experience, a continual learning algorithm should not have direct access to past tasks or be able to rewind the environment; In the previous edition of the workshop the focus has been on defining a complete list of desiderata, of what a continual learning (CL) enabled system should be able to do. We believe that in this edition we should further constrain the discussion with a focus on how to evaluate CL and how it relates to other existing topics (e.g. life-long learning, transfer learning, meta-learning) and how ideas from these topics could be useful for continual learning. Different aspects of continual learning are in opposition of each other (e.g. fixed model capacity and not-forgetting), which also raises the question of how to evaluate continual learning systems. One on hand, what are the right trade-offs between these different opposing forces? How do we compare existing algorithms given these different dimensions along which we should evaluate them (e.g. forgetting, positive transfer)? What are the right metrics we should report? On the other hand, optimal or meaningful trade-offs will be tightly defined by the data or at least type of tasks we use to test the algorithms. One prevalent task used by many recent papers is PermutatedMNIST. But as MNIST is not a reliable dataset for classification, so PermutatedMNIST might be extremely misleading for continual learning. What would be the right benchmarks, datasets or tasks for fruitfully exploiting this topic? Finally, we will also encourage presentation of both novel approaches to CL and implemented systems, which will help concretize the discussion of what CL is and how to evaluate CL systems.

Continual Learning

Razvan Pascanu, Yee Teh, Marc Pickett, Mark Ring

Fri Dec 07, 08:00 AM
Previously, the first MLPCD workshop edition, held at NIPS 2017 was successful, attracted over 200+ attendees and led to active research & panel discussions as well as follow-up contributions to the open-source community (e.g., release of new inference libraries, tools, models and standardized representations of deep learning models). We believe that interest in this space is only going to increase, and we hope that the workshop plays the role of an influential catalyst to foster research and collaboration in this nascent community.

After the first workshop where we investigated initial directions and trends, the NIPS 2018 MLPCD workshop focuses on theory and practical applications of on-device machine learning, an area that is highly relevant and specializes in the intersection of multiple topics of interest to NIPS and broader machine learning community -- efficient training & inference for deep learning and other machine learning models; interdisciplinary mobile applications involving vision, language & speech understanding; and emerging topics like Internet of Things.

We plan to incorporate several new additions this year -- inspirational opening Keynote talk on "future of intelligent assistive & wearable experiences"; two panels including a lively closing panel debate discussing pros/cons of two key ML computing paradigms (Cloud vs. On-device); solicited research papers on new & recent hot topics (e.g., theoretical & algorithmic work on low-precision models, compression, sparsity, etc. for training and inference), related challenges, applications and recent trends; demo session showcasing ML in action for real-world apps.

Description & Topics:

Deep learning and machine learning, in general, has changed the computing paradigm. Products of today are built with machine intelligence as a central attribute, and consumers are beginning to expect near-human interaction with the appliances they use. However, much of the Deep Learning revolution has been limited to the cloud, enabled by popular toolkits such as Caffe, TensorFlow, and MxNet, and by specialized hardware such as TPUs. In comparison, mobile devices until recently were just not fast enough, there were limited developer tools, and there were limited use cases that required on-device machine learning. That has recently started to change, with the advances in real-time computer vision and spoken language understanding driving real innovation in intelligent mobile applications. Several mobile-optimized neural network libraries were recently announced (CoreML, Caffe2 for mobile, TensorFlow Lite), which aim to dramatically reduce the barrier to entry for mobile machine learning. Innovation and competition at the silicon layer has enabled new possibilities for hardware acceleration. To make things even better, mobile-optimized versions of several state-of-the-art benchmark models were recently open sourced. Widespread increase in availability of connected “smart” appliances for consumers and IoT platforms for industrial use cases means that there is an ever-expanding surface area for mobile intelligence and ambient devices in homes. All of these advances in combination imply that we are likely at the cusp of a rapid increase in research interest in on-device machine learning, and in particular, on-device neural computing.

Significant research challenges remain, however. Mobile devices are even more personal than “personal computers” were. Enabling machine learning while simultaneously preserving user trust requires ongoing advances in the research of differential privacy and federated learning techniques. On-device ML has to keep model size and power usage low while simultaneously optimizing for accuracy. There are a few exciting novel approaches recently developed in mobile optimization of neural networks. Lastly, the newly prevalent use of camera and voice as interaction models has fueled exciting research towards neural techniques. On-device ML has to keep model size and power usage low while simultaneously optimizing for accuracy. There are a few exciting novel approaches recently developed in mobile optimization of neural networks. Lastly, the newly prevalent use of camera and voice as interaction models has fueled exciting research towards neural techniques for image and speech/language understanding. This is an area that is highly relevant to multiple topics of interest to NIPS -- e.g., core topics like machine learning & efficient inference and interdisciplinary applications involving vision, language & speech understanding as well as emerging area (namely, Internet of Things).

With this emerging interest as well as the wealth of challenging research problems in mind, we are proposing the second NIPS 2018 workshop dedicated to on-device machine learning for mobile and ambient home consumer devices.

Areas/topics of interest include, but not limited to:

* Model compression for efficient inference with deep networks and other ML models
* Privacy preserving machine learning
* Low-precision training/inference & Hardware acceleration of neural computing on mobile devices
* Real-time mobile computer vision
* Language understanding and conversational assistants on mobile devices
* Speech recognition on mobile and smart home devices
* Machine intelligence for mobile gaming
* ML for mobile health other real-time prediction scenarios
* ML for on-device applications in the automotive industry (e.g., computer vision for self-driving cars)
* Software libraries (including open-source) optimized for on-device ML

Target Audience:

The next wave of ML applications will have significant processing on mobile and ambient devices. Some immediate examples of these are single-image classification, depth estimation, object recognition and segmentation running on-device for creative effects, or on-device recommender and ranking systems for privacy-preserving, low-latency experiences. This workshop will bring ML practitioners up to speed on the latest trends for on-device applications of ML, offer an overview of the latest HW and SW framework developments, and champion active research towards hard technical challenges emerging in this nascent area. The target audience for the workshop is both industrial and academic researchers and practitioners of on-device, native machine learning. The workshop will cover both “informational” and “aspirational” aspects of this emerging research area for delivering ground-breaking experiences on real-world products.

Given the relevance of the topic, target audience (mix of industry + academia & related parties) as well as the timing (confluence of research ideas + practical implementations both in industry as well as through publicly available toolkits ), we feel that NIPS 2018 would continue to be a great venue for this workshop.

Bayesian Deep Learning
While deep learning has been revolutionary for machine learning, most modern deep learning models cannot represent their uncertainty nor take advantage of the well studied tools of probability theory. This has started to change following recent developments of tools and techniques combining Bayesian approaches with deep learning. The intersection of the two fields has received great interest from the community over the past few years, with the introduction of new deep learning models that take advantage of Bayesian techniques, as well as Bayesian models that incorporate deep learning elements [1-11]. In fact, the use of Bayesian techniques in deep learning can be traced back to the 1990s’, in seminal works by Radford Neal [12], David MacKay [13], and Dayan et al. [14]. These gave us tools to reason about deep models’ confidence, and achieved state-of-the-art performance on many tasks. However earlier tools did not adapt when new needs arose (such as scalability to big data), and were consequently forgotten. Such ideas are now being revisited in light of new advances in the field, yielding many exciting new results. Extending on the workshop’s success from the past couple of years, this workshop will again study the advantages and disadvantages of the ideas above, and will be a platform to host the recent flourish of ideas using Bayesian approaches in deep learning and using deep learning tools in Bayesian modelling. The program includes a mix of invited talks, contributed talks, and contributed posters. The main theme this year will be applications of Bayesian deep learning in the real world, highlighting the requirements of practitioners from the research community. Future directions for the field will be debated in a panel discussion. Call for papers: please see http://bayesiandeeplearning.org/

**Modeling the Physical World: Learning, Perception, and Control**

**Fri Dec 07, 08:00 AM**

Despite recent progress, AI is still far from achieving common-sense scene understanding and reasoning. A core component of this common sense is a useful representation of the physical world and its dynamics that can be used to predict and plan based on how objects interact. This capability is universal in adults, and is found to a certain extent even in infants. Yet despite increasing interest in the phenomenon in recent years, there are currently no models that exhibit the robustness and flexibility of human physical reasoning.

There have been many ways of conceptualizing models of physics, each with their complementary strengths and weaknesses. For instance, traditional physical simulation engines have typically used symbolic or analytic systems with “built-in” knowledge of physics, while recent connectionist methods have demonstrated the capability to learn approximate, differentiable system dynamics. While more precise, symbolic models of physics might be useful for long-term prediction and physical inference; approximate, differentiable models might be more practical for inverse dynamics and system identification. The design of a physical dynamics model fundamentally affects the ways in which that model can, and should, be used.

This workshop will bring together researchers in machine learning, computer vision, robotics, computational neuroscience, and cognitive psychology to discuss artificial systems that capture or model the physical world. It will also explore the cognitive foundations of physical representations, their interaction with perception, and their applications in planning and control. There will be invited talks from world leaders in the fields, presentations and poster sessions based on contributed papers, and a panel discussion.

**Topics of discussion will include**
- Building and learning physical models (deep networks, structured probabilistic generative models, physics engines)
- How to combine model-based and model-free approaches to physical prediction
- How to use physics models in higher-level tasks such as navigation, video prediction, robotics, etc.
- How perception and action interact with physical representations
- How cognitive science and computational neuroscience may inform the design of artificial systems for physical prediction
- Methodology for comparing models of infant learning with artificial systems
- Development of new datasets or platforms for physics and visual common sense

**Causal Learning**

**Martin Arjovsky, Christina Heinze-Deml, Anna Klimovskaiia, Maxime Oquab, Leon Bottou, David Lopez-Paz**

**Fri Dec 07, 08:00 AM**

The route from machine learning to artificial intelligence remains uncharted. Recent efforts describe some of the conceptual problems that lie along this route [4, 9, 12]. The goal of this workshop is to investigate how much progress is possible by framing these problems beyond learning correlations, that is, by uncovering and leveraging causal relations: 1. Machine learning algorithms solve statistical problems (e.g. maximum likelihood) as a proxy to solve tasks of interest (e.g. recognizing objects). Unfortunately, spurious correlations and biases are often easier to learn than the task itself [14], leading to unreliable or unfair predictions. This phenomenon can be framed as causal confounding. 2. Machines trained on large pools of i.i.d. data often crash confidently when deployed in different circumstances (e.g., adversarial examples, dataset biases [18]). In contrast, humans seek prediction rules robust across multiple conditions. Allowing machines to learn robust rules from multiple environments can be framed as searching for causal invariances [2, 11, 16, 17]. 3. Humans benefit from discrete structures to reason. Such structures seem less useful to learning machines. For instance, neural machine translation systems outperform those that model language structure. However, the purpose of this structure might not be modeling common sentences, but to help us formulate new ones. Modeling new potential sentences rather than observed ones is a form of counterfactual reasoning [8, 9]. 4. Intelligent agents do not only observe, but also shape the world with actions. Maintaining plausible causal models of the world allows to build intuitions, as well as to design intelligent experiments and interventions to test them [16, 17]. Is causal understanding necessary for efficient reinforcement learning? 5. Humans
This workshop thus aims to gather people from various backgrounds - machine learning, computer vision, natural language processing, neuroscience, cognitive science, psychology, and philosophy - to share and debate their perspectives on why grounding may (or may not) be important in building machines that truly understand natural language.

We invite you to submit papers related to the following topics:

- visual captioning, dialog, and question-answering
- reasoning in language and vision
- visual synthesis from language
- transfer learning in language and vision tasks
- navigation in virtual worlds via natural-language instructions or multi-agent communication
- machine translation with visual cues
- novel tasks that combine language, vision and actions
- modeling of natural language and visual stimuli representations in the human brain
- position papers on grounded language learning
- audio-visual scene-aware dialog

Submissions should be up to 4 pages excluding references, acknowledgements, and supplementary material, and should be in the NIPS format. We also welcome published papers that are within the scope of the workshop (without re-formattting). Please email your submission to vigilworkshop2018@gmail.com before or on November 1st 2018.


MLSys: Workshop on Systems for ML and Open Source Software

Aparna Lakshmiratan, Sarah Bird, Siddhartha Sen, Joseph Gonzalez, Dan Crankshaw

Fri Dec 07, 08:00 AM

This workshop is part two of a two-part series with one day focusing on ML for Systems and the other on Systems for ML. Although the two workshops are being led by different organizers, we are coordinating our call for papers to ensure that the workshops complement each other and that submitted papers are routed to the appropriate venue.

The ML for Systems workshop focuses on developing ML to optimize systems while we focus on designing systems to enable large scale ML with Systems for ML. Both fields are mature enough to warrant a dedicated workshop. Organizers on both sides are open to merging in the future, but this year we plan to run them separately on two different days.

A new area is emerging at the intersection of artificial intelligence, machine learning, and systems design. This has been accelerated by the explosive growth of diverse applications of ML in production, the continued growth in data volume, and the complexity of large-scale learning systems. The goal of this workshop is to bring together experts working at the crossroads of machine learning, system design and software engineering to explore the challenges faced when building large-scale ML systems. In particular, we aim to elicit new connections among these diverse fields, identifying theory, tools and design principles tailored to practical machine learning workflows. We also want to think about best practices for research in this area and how to evaluate it. The workshop will cover state of the art ML and AI platforms and algorithm toolkits (e.g. TensorFlow, PyTorch1.0, MXNet etc.), as well as dive into machine learning-focused developments in distributed learning platforms, programming languages, data structures, GPU processing, and other topics.

This workshop will follow the successful model we have previously run at ICML, NIPS and SOSP 2017.
Our plan is to run this workshop annually co-located with one ML venue and one Systems venue, to help build a strong community which we think will complement newer conferences like SysML targeting research at the intersection of systems and machine learning. We believe this dual approach will help to create a low barrier to participation for both communities.

Schedule

09:00 AM  Welcome

NIPS 2018 workshop on Compact and interoperable Deep Neural Networks with industrial applications

Lixin Fan, Zhouchen Lin, Max Welling, Yurong Chen, Werner Bailer

Fri Dec 07, 08:00 AM

This workshop aims to bring together researchers, educators, practitioners who are interested in techniques as well as applications of making compact and efficient neural network representations. One main theme of the workshop discussion is to build up consensus in this rapidly developed field, and in particular, to establish close connection between researchers in Machine Learning community and engineers in industry. Therefore we believe the workshop is beneficial to both academic researchers as well as industrial practitioners. Topics of interest include, but not limited to, following aspects: Neural network compression techniques: Binarization, quantization, pruning, thresholding and coding of neural networks Efficient computation and acceleration of deep convolutional neural networks Low power consumption of deep neural network computation Differentiable sparsification and quantization of deep neural networks Benchmarking of deep neural network compression techniques Video & media compression methods using DNNs such as those developed in MPEG group: Exchange formats for (trained) neural networks Efficient deployment strategies for neural networks Approaches for lightweight inference on mobile and IoT devices To improve video coding standard development by using deep neural networks To increase practical applicability of network compression methods Evaluating performances of the uncompressed networks and the original one Industrial standardization of deep neural network representations

Imitation Learning and its Challenges in Robotics

Mustafa Mukadam, Sanjiban Choudhury, Siddhartha Srinivasa

Fri Dec 07, 08:00 AM

Many animals including humans have the ability to acquire skills, knowledge, and social cues from a very young age. This ability to imitate by learning from demonstrations has inspired research across many disciplines like anthropology, neuroscience, psychology, and artificial intelligence. In AI, imitation learning (IL) serves as an essential tool for learning skills that are difficult to program by hand. The applicability of IL to robotics in particular, is useful when learning by trial and error (reinforcement learning) can be hazardous in the real world. Despite the many recent breakthroughs in IL, in the context of robotics there are several challenges to be addressed if robots are to operate freely and interact with humans in the real world.

Some important challenges include: 1) achieving good generalization and sample efficiency when the user can only provide a limited number of demonstrations with little to no feedback; 2) learning safe behaviors in human environments that require the least user intervention in terms of safety overrides without being overly conservative; and 3) leveraging data from multiple sources, including non-human sources, since limitations in hardware interfaces can often lead to poor quality demonstrations.

In this workshop, we aim to bring together researchers and experts in robotics, imitation and reinforcement learning, deep learning, and human robot interaction to:
- Formalize the representations and primary challenges in IL as they pertain to robotics
- Delineate the key strengths and limitations of existing approaches with respect to these challenges
- Establish common baselines, metrics, and benchmarks, and identify open questions

Workshop on Security in Machine Learning

Nicolas Papernot, Jacob Steinhardt, Matt Fredrikson, Kamalika Chaudhuri, Florian Tramer

Fri Dec 07, 08:00 AM

There is growing recognition that ML exposes new vulnerabilities in software systems. Some of the threat vectors explored so far include training data poisoning, adversarial examples or model extraction. Yet, the technical community’s understanding of the nature and extent of the resulting vulnerabilities remains limited. This is due in part to (1) the large attack surface exposed by ML algorithms because they were designed for deployment in benign environments—as exemplified by the IID assumption for training and test data, (2) the limited availability of theoretical tools to analyze generalization, (3) the lack of reliable confidence estimates. In addition, the majority of work so far has focused on a small set of application domains and threat models.

This workshop will bring together experts from the computer security and machine learning communities in an attempt to highlight recent work that contribute to address these challenges. Our agenda will complement contributed papers with invited speakers. The latter will emphasize connections between ML security and other research areas such as accountability or formal verification, as well as stress social aspects of ML misuse. We hope this will help identify fundamental directions for future cross-community collaborations, thus charting a path towards secure and trustworthy ML.

Workshop on Social, Political, and Ethical Issues in AI

Chloe Bakalar, Sarah Bird, Tiberio Caetano, Edward W Felten, Dario Garcia, Isabel Kloumann, Finnian Lattimore, Sendhil Mullainathan, D. Sculley
Fri Dec 07, 08:00 AM

Abstract Ethics is the philosophy of human conduct: It addresses the question “how should we act?” Throughout most of history the repertoire of actions available to us was limited and their consequences constrained in scope and impact through dispersed power structures and slow trade. Today, in our globalised and networked world, a decision can affect billions of people instantaneously and have tremendously complex repercussions. Machine learning algorithms are replacing humans in making many of the decisions that affect our everyday lives. How can we decide how machine learning algorithms and their designers should act? What is the ethics of today and what will it be in the future? In this one day workshop we will explore the interaction of AI, society, and ethics through three general themes. Advancing and Connecting Theory: How do different fairness metrics relate to one another? What are the trade-offs between them? How do fairness, accountability, transparency, interpretability and causality relate to ethical decision making? What principles can we use to guide us in selecting fairness metrics within a given context? Can we connect these principles back to ethics in philosophy? Are these principles still relevant today? Tools and Applications: Real-world examples of how ethical considerations are affecting the design of ML systems and pipelines. Applications of algorithmic fairness, transparency or interpretability to produce better outcomes. Tools that aid identifying and or alleviating issues such as bias, discrimination, filter bubbles, feedback loops etc. and enable actionable exploration of the resulting trade-offs. Regulation: With the GDPR coming into force in May 2018 it is the perfect time to examine how regulation can help (or hinder) our efforts to deploy AI for the benefit of society. How are companies and organisations responding to the GDPR? What aspects are working and what are the challenges? How can regulatory or legal frameworks be designed to continue to encourage innovation, so society as a whole can benefit from AI, whilst still providing protection against its harms. This workshop is designed to be focused on some of the larger ethical issues related to AI and can be seen as a complement to the FATML proposal, which is focused more on fairness, transparency and accountability. We would be happy to link or cluster the workshops together, but we (us and the FATML organizers) think that there is more than 2 day worth of material that the community needs to discuss in the area of AI and ethics, so it would be great to have both workshops if possible.

The second Conversational AI workshop – today’s practice and tomorrow’s potential

Alborz Geramifard, Jason D. Williams, Larry Heck, Jim Glass, Milica Gasic, Dilek Hakkani-Tur, Steve Young, Lazaros C. Polymenakos, Y-Lan Boureau, Maxine Eskenazi

Fri Dec 07, 08:00 AM

In the span of only a few years, conversational systems have become commonplace. Every day, millions of people use natural-language interfaces such as Siri, Google Now, Cortana, Alexa and others via in-home devices, phones, or messaging channels such as Messenger, Slack, Skype, among others. At the same time, interest among the research community in conversational systems has blossomed: for supervised and reinforcement learning, conversational systems often serve as both a benchmark task and an inspiration for new ML methods at conferences which don’t focus on speech and language per se, such as NIPS, ICML, IJCAI, and others. Research community challenge tasks are proliferating, including the seventh Dialog Systems Technology Challenge (DSTC7), the Amazon Alexa prize, and the Conversational Intelligence Challenge live competitions at NIPS (2017, 2018). Following the overwhelming participation in our last year NIPS workshop (9 invited talks, 26 submissions, 3 orals papers, 13 accepted papers, 37 PC members, and couple of hundreds of participants), we are excited to continue promoting cross-pollination of ideas between academic research centers and industry. The goal of this workshop is to bring together researchers and practitioners in this area, to clarify impactful research problems, share findings from large-scale real-world deployments, and generate new ideas for future lines of research. This workshop will include invited talks from academia and industry, contributed work, and open discussion. In these talks, senior technical leaders from many of the most popular conversational services will give insights into real usage and challenges at scale. An open call for papers will be issued, and we will prioritize forward-looking papers that propose interesting and impactful contributions. We will end the day with an open discussion, including a panel consisting of academic and industrial researchers.

Machine Learning for Geophysical & Geochemical Signals

Laura Pyrak-Nolte, Jim R Rustad, Richard Baraniuk

Fri Dec 07, 08:00 AM

Motivation

The interpretation of Earth’s subsurface evolution from full waveform analysis requires a method to identify the key signal components related to the evolution in physical properties from changes in stress, fluids, geochemical interactions and other natural and anthropogenic processes. The analysis of seismic waves and other geophysical/geochemical signals remains for the most part a tedious task that geoscientists may perform by visual inspection of the available seismograms. The complexity and noisy nature of a broad array of geoscience signals combined with sparse and irregular sampling make this analysis difficult and imprecise. In addition, many signal components are ignored in tomographic imaging and continuous signal analysis that may prevent discovery of previously unrevealed signals that may point to new physics.

Ideally a detailed interpretation of the geometric contents of these data sets would provide valuable prior information for the solution of corresponding inverse problems. This unsatisfactory state of affairs is indicative of a lack of effective and robust algorithms for the computational parsing and interpretation of seismograms (and other geoscientia data sets). Indeed, the limited frequency content, strong nonlinearity, temporally scattered nature of these signals make their analysis with standard signal processing techniques difficult and insufficient.

Once important seismic phases are identified, the next challenge is determining the link between a remotely-measured geophysical response and a characteristic property (or properties) of the fractures and fracture system. While a strong laboratory-based foundation has established a link between the mechanical properties of simple fracture systems (i.e. single fractures, parallel sets of fractures) and elastic wave scattering, bridging to the field scale faces additional complexity and a
range of length scales that cannot be achieved from laboratory insight alone. This fundamental knowledge gap at the critical scale for long-term monitoring and risk assessment can only be narrowed or closed with the development of appropriate mathematical and numerical representations at each scale and across scales using multiphysics models that traverse spatial and temporal scales.

Target Audience
We aim to elicit new connections among these diverse fields, identify novel tools and models that can be transferred from one to the other, and explore novel ML applications that will benefit from ML algorithms paradigm. We believe that a successful workshop will lead to new research directions in a variety of areas and will also inspire the development of novel theories and tools.

The goals of this workshop are to:
(1) bring together experts from different fields of ML and geophysics to explore the use of ML techniques related to the identification of the physics contained in geophysical and chemical signals, as well as from images of geologic materials (minerals, fracture patterns, etc.); and
(2) announce a set of geophysics machine learning challenges to the community that address earthquake detection and the physics of rupture and the timing of earthquakes.

Schedule

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<td>09:05 AM</td>
<td>Greg Beroza, Mostafa Mousavi, and Weiqiang Zhu.</td>
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Abstracts (8):

Abstract 1: Introduction in Machine Learning for Geophysical & Geochemical Signals, Pyrak-Nolte, Rustad, Baraniuk 08:30 AM

Introductory comments by organizers

Abstract 2: Paul Johnson in Machine Learning for Geophysical & Geochemical Signals, Johnson 08:40 AM

Probing Earthquake Fault Slip using Machine Learning

Earthquakes take place when two juxtaposed fault blocks are stressed sufficiently to overcome the frictional force holding them in place and they abruptly slip relative to each other. Earthquake faults exhibit a continuum of behaviors ranging from stick slip associated with strong shaking, to slow slip which is primarily aseismic, to very slow slip that is both aseismic and can take place over hours to months. We are characterizing faulting physics by analyzing with machine learning continuous acoustic data streams in the laboratory and continuous seismic data streams in Earth. We use as labels characteristics of the measured fault slip behavior in the laboratory such as the fault friction, shear displacement and fault thickness. In Earth, we use surface displacement as determined by Global Positioning Systems (GPS). Other data data such as INSAR can be used as well. We find that the laboratory acoustic data and the Earth seismic data are a type of Rosetta Stone revealing fault characteristics at all times and fault displacements. This is a surprising observation because previously we believed most or much of the signal was noise. Here we describe an overview of recent work in this area and also describe recent efforts on parallel problems such as volcanoes and geysers.

Abstract 5: Karianne Jodine Bergen in Machine Learning for Geophysical & Geochemical Signals, Bergen 09:55 AM

Towards data-driven earthquake detection: Extracting weak seismic signals with locality-sensitive hashing

Extracting weak earthquake signals from continuous waveform data recorded by sensors in a seismic network is a fundamental and challenging task in seismology. In this talk, I will present Fingerprint and Similarity Thresholding (FAST; Yoon et al, 2015), a computationally efficient method for large-scale earthquake detection. FAST adapts technology used for rapid audio identification to the problem of extracting weak earthquake signals in continuous seismic data. FAST uses locality-sensitive hashing, a data mining technique for efficiently identifying similar items in large data sets, to detect similar waveforms (candidate earthquakes) in continuous seismic data. A distinguishing feature of our approach is that FAST is an unsupervised detector; FAST can discover new sources without any template waveforms or waveform characteristics available as training data — a common situation for seismic data sets. In our recent work, we have extended FAST to enable earthquake detection using data from multiple sensors spaced tens or hundreds of kilometers apart (Bergen and Beroza, 2018), and optimized
the FAST software for detection at scale (Rong et al., 2018). FAST can now detect earthquakes with previously unknown sources in 10-year, multi-sensor seismic data sets without training data – a capability that was not previously available for seismic data analysis.

Abstract 10: Bertrand Rouet-Leduc in Machine Learning for Geophysical & Geochemical Signals, Rouet-Leduc 02:00 PM

Estimating the State of Faults from the Full Continuous Seismic Data Using Machine Learning

Abstract 11: Joan Bruna in Machine Learning for Geophysical & Geochemical Signals, 02:20 PM

Geometric Deep Learning for Many-Particle and non Euclidean systems

Abstract 12: Claudia Hulbert in Machine Learning for Geophysical & Geochemical Signals, 02:40 PM

Machine Learning Reveals the Coupling Between Slow Slips and Major Earthquakes

Abstract 15: Joe Morris in Machine Learning for Geophysical & Geochemical Signals, Morris 03:50 PM

Towards Realtime Hydraulic Fracture Monitoring using Machine Learning and Distributed Fiber Sensing

Abstract 16: Youzou Lin in Machine Learning for Geophysical & Geochemical Signals, Lin 04:10 PM

Accurate and Efficient Seismic Waveform-Inversion with Convolutional Neural Networks

Seismic full-waveform inversion has become a promising tool for velocity estimation in complex geological structures. The traditional seismic full-waveform inversion problems are usually posed as nonlinear optimization problems. Solving full-waveform inversion can be computationally challenging for two major reasons. One is the expensive computational cost and the other is the issue of local minima. In this work, we develop an end-to-end data-driven inversion technique, called “InversionNet”, to learn a regression relationship from seismic waveform datasets to subsurface models. Specifically, we build a novel deep convolutional neural network with an encoder-decoder structure, where the encoder learns an abstract representation of the seismic data, which is then used by the decoder to produce a subsurface model. We further incorporate atrous convolutions in our network structure to account for contextual information from the subsurface model. We evaluate the performance of our InversionNet with synthetic seismic waveform data. The experiment results demonstrate that our InversionNet not only yields accurate inversion results but also produces almost real-time inversion.

Challenges and Opportunities for AI in Financial Services: the Impact of Fairness, Explainability, Accuracy, and Privacy

Manuela Veloso, Nathan Kallus, Sameena Shah, Senthil Kumar, Isabelle Moulinier, Jiahao Chen, John Paisley

Fri Dec 07, 08:00 AM

The adoption of artificial intelligence in the financial service industry, particularly the adoption of machine learning, presents challenges and opportunities. Challenges include algorithmic fairness, explainability, privacy, and requirements of a very high degree of accuracy. For example, there are ethical and regulatory needs to prove that models used for activities such as credit decisioning and lending are fair and unbiased, or that machine reliance doesn’t cause humans to miss critical pieces of data. For some use cases, the operating standards require nothing short of perfect accuracy. Privacy issues around collection and use of consumer and proprietary data require high levels of scrutiny. Many machine learning models are deemed unusable if they are not supported by appropriate levels of explainability. Some challenges like entity resolution are exacerbated because of scale, highly nuanced data points and missing information. On top of these fundamental requirements, the financial industry is ripe with adversaries who purport fraud and other types of risks. The aim of this workshop is to bring together researchers and practitioners to discuss challenges for AI in financial services, and the opportunities such challenges represent to the community. The workshop will consist of a series of sessions, including invited talks, panel discussions and short paper presentations, which will showcase ongoing research and novel algorithms.

Modeling and decision-making in the spatiotemporal domain

Ransalu Senanayake, Neal Jean, Fabio Ramos, Girish Chowdhary

Fri Dec 07, 08:00 AM

### Abstract Understanding the evolution of a process over space and time is fundamental to a variety of disciplines. To name a few, such phenomena that exhibit dynamics in both space and time include propagation of diseases, variations in air pollution, dynamics in fluid flows, and patterns in neural activity. In addition to these fields in which modeling the nonlinear evolution of a process is the focus, there is also an emerging interest in decision-making and controlling of autonomous agents in the spatiotemporal domain. That is, in addition to learning what actions to take, when and where to take actions is crucial for an agent to efficiently and safely operate in dynamic environments. Although various modeling techniques and conventions are used in different application domains, the fundamental principles remain unchanged. Automatically capturing the dependencies between spatial and temporal components, making accurate predictions into the future, quantifying the uncertainty associated with predictions, real-time performance, and working in both big data and data scarce regimes are some of the key aspects that deserve our attention. Establishing connections between Machine Learning and Statistics, this workshop aims at: 1. raising open questions on challenges of spatiotemporal modeling and decision-making, 2. establishing connections among diverse application domains of spatiotemporal modeling, and 3. encouraging conversation between theoreticians and practitioners to develop robust predictive models. ### Keywords ”Theory:**” deep learning/convolutional LSTM, kernel methods, chaos theory, reinforcement learning for dynamic environments, dynamic policy learning, biostatistics, epidemiology, geostatistics, climatology, neuroscience, etc. **Applications:**” * ”Natural phenomena:** disease propagation and outbreaks, environmental monitoring, climate modeling, etc. * ”Social sciences and economics:** predictive policing, population mapping, poverty mapping, food resources, agriculture, etc. * ”Engineering/robotics:** active data collection, traffic modeling, motion prediction, fluid dynamics,
spatiotemporal prediction for safe autonomous driving, etc. More information

[https://sites.google.com/site/nips18spatiotemporal/](https://sites.google.com/site/nips18spatiotemporal/)

**Schedule**

08:30 AM  Introduction
There has been a host of recent work towards solving text games, typically informed by prior world/linguistic knowledge. The state is not known in advance but must be learned through exploration/experimentation, affordance extraction [Fulda et al., 2017], and common sense. Text games also highlight major open challenges, such as aiding rescue workers allocate resources during natural disasters, providing intelligent educational and healthcare services in regions with few human experts, and detecting corruption in government contracts. While ML represents a tremendous hope for accelerated development and societal change, it is often difficult to ensure that machine learning projects provide their promised benefit. The challenging reality in developing regions is that pilot projects disappear after a few years or do not have the same effect when expanded beyond the initial test site, and prototypes of novel methodologies are often never deployed.

At the center of this year’s program is how to achieve sustainable impact of Machine Learning for the Developing World (ML4D). This one-day workshop will bring together a diverse set of participants from across the globe to discuss major roadblocks and paths to action. Practitioners and development experts will discuss essential elements for ensuring sustainable impact.
successful deployment and maintenance of technology in developing regions. Additionally, the workshop will feature cutting edge research in areas such as transfer learning, unsupervised learning, and active learning that can help ensure long-term ML system viability. Attendees will learn about contextual components to ensure effective projects, development challenges that can benefit from machine learning solutions, and how these problems can inspire novel machine learning research.

The workshop will include invited and contributed talks, a poster session of accepted papers, panel discussions, and breakout sessions tailored to the workshop theme. We welcome paper submissions focussing on core ML methodology addressing ML4D roadblocks, application papers that showcase successful examples of ML4D, and research that evaluates the societal impact of ML.

### Reinforcement Learning under Partial Observability

**Joni Pajarinen, Chris Amato, Pascal Poupart, David Hsu**

Sat Dec 08, 08:00 AM

Reinforcement learning (RL) has succeeded in many challenging tasks such as Atari, Go, and Chess and even in high dimensional continuous domains such as robotics. Most impressive successes are in tasks where the agent observes the task features fully. However, in real world problems, the agent usually can only rely on partial observations. In real time games the agent makes only local observations; in robotics the agent has to cope with noisy sensors, occlusions, and unknown dynamics. Even more fundamentally, any agent without a full a priori world model or without full access to the system state, has to make decisions based on partial knowledge about the environment and its dynamics.

Reinforcement learning under partial observability has been tackled in the operations research, control, planning, and machine learning communities. One of the goals of the workshop is to bring researchers from different backgrounds together. Moreover, the workshop aims to highlight future applications. In addition to robotics where partial observability is a well known challenge, many diverse applications such as wireless networking, human-robot interaction and autonomous driving require taking partial observability into account.

Partial observability introduces unique challenges: the agent has to remember the past but also connect the present with potential futures requiring memory, exploration, and value propagation techniques that can handle partial observability. Current model-based methods can handle discrete values and take long term information gathering into account while model-free methods can handle high-dimensional continuous problems but often assume that the state space has been created for the problem at hand such that there is sufficient information for optimal decision making or just add memory to the policy without taking partial observability explicitly into account.

In this workshop, we want to go further and ask among others the following questions.

* How can we extend deep RL methods to robustly solve partially observable problems?
* Can we learn concise abstractions of history that are sufficient for high-quality decision-making?

### Privacy Preserving Machine Learning

**Aurélien Bellet, Adria Gascon, Niki Kilbertus, Olga Ohrimenko, Mariana Raykova, Adrian Weller**

Sat Dec 08, 08:00 AM

### Please visit our [website](https://ppml-workshop.github.io/)

Description This one day workshop focuses on privacy preserving techniques for training, inference, and disclosure in large scale data analysis, both in the distributed and centralized settings. We have observed increasing interest of the ML community in leveraging cryptographic techniques such as Multi-Party Computation (MPC) and Homomorphic Encryption (HE) for privacy preserving training and inference, as well as Differential Privacy (DP) for disclosure. Simultaneously, the systems security and cryptography community has proposed various secure frameworks for ML. We encourage both theory and application-oriented submissions exploring a range of approaches, including: - secure multi-party computation techniques for ML - homomorphic encryption techniques for ML - hardware-based approaches to privacy preserving ML - centralized and decentralized protocols for learning on encrypted data - differential privacy: theory, applications, and implementations - statistical notions of privacy including relaxations of differential privacy - empirical and theoretical comparisons between different notions of privacy - trade-offs between privacy and utility. We think it will be very valuable to have a forum to unify different perspectives and start a discussion about the relative merits of each approach. The workshop will also serve as a venue for networking people from different communities interested in this problem, and hopefully foster fruitful long-term collaboration. Further information, CFP, and submission instructions can be found [here](https://ppml-workshop.github.io/).

### AI for social good

**Margaux Luck, Tristan Sylvain, Joseph Paul Cohen, Arsene Fansi Tchango, Valentine Goddard, Aurelie Helouis, Yoshua Bengio, Sam Greydanus, Cody Wild, Taras Kucherenko, Arya Farahi, Jonnie Penn, Sean McGregor, Mark Crowley, Abhishek Gupta, Kenny Chen, etc.**

Generated Tue Sep 04, 2018
# AI for Social Good

## Important information

[Workshop website](https://aiforsocialgood.github.io/2018/)

## Abstract

The “AI for Social Good” workshop will focus on social problems for which artificial intelligence has the potential to offer meaningful solutions. The problems we chose to focus on are inspired by the United Nations Sustainable Development Goals (SDGs), a set of seventeen objectives that must be addressed in order to bring the world to a more equitable, prosperous, and sustainable path. In particular, we will focus on the following areas: health, education, protecting democracy, urban planning, assistive technology for people with disabilities, agriculture, environmental sustainability, economic inequality, social welfare and justice.

Each of these themes present opportunities for AI to meaningfully impact society by reducing human suffering and improving our democracies. The AI for Social Good workshop divides the in-focus problem areas into thematic blocks of talks, panels, breakout planning sessions, and posters. Particular emphasis is given to celebrating recent achievements in AI solutions, and fostering collaborations for the next generation of solutions for social good. First, the workshop will feature a series of invited talks and panels on agriculture and environmental protection, education, health and assistive technologies, urban planning and social services. Secondly, it will bring together ML researchers, leaders of social impact, people who see the needs in the field as well as philanthropists in a forum to present and discuss interesting research ideas and applications with the potential to address social issues.

Indeed, the rapidly expanding field of AI has the potential to transform many aspects of our lives. However, two main problems arise when attempting to tackle social issues. There are few venues in which to share successes and failures in research at the intersection of AI and social problems, an absence this workshop is designed to address by showcasing these marginalized but impactful works of research. Also, it is difficult to find and evaluate problems to address for researchers with an interest on having a social impact. We hope this will inspire the creation of new tools by the community to tackle these important problems. Also, this workshop promotes the sharing of information about datasets and potential projects which could interest machine learning researchers who want to apply their skills for social good. The workshop also explores how artificial intelligence can be used to enrich democracy, social welfare, and justice. A focus on these topics will connect researchers to civil society organizations, NGOs, local governments, and other organizations to enable applied AI research for beneficial outcomes. Various case-studies and discussions are introduced around these themes: summary of existing AI for good projects and key issues for the future, AI’s impact on economic inequality, AI approaches to social sciences, and civil society organizations. The definition of what constitutes social good being essential to this workshop, we will have panel discussions with leading social scholars to frame how contemporary AI/ML applications relate to public and philosophical notions of social good. We also aim to define new, quantifiable, and impactful research questions for the AI/ML community. Also, we would like as an outcome of this event the creation of a platform to share data, a pact with leading tech companies to support research staff sabbaticals with social progress organizations, and the connection of researchers to on-the-ground problem owners and funders for social impact. We invite contributions relating to any of the workshop themes or more broadly any of the UN SDGs. The models or approaches presented do not necessarily need to be of outstanding theoretical novelty, but should demonstrate potential for a strong social impact. We invite two types of submissions. First, we invite research work as short papers (4 page limit) for oral and/or poster presentation. Second, we invite two page abstracts presenting a specific solution that would, if accepted, be discussed during round-table events. The short papers should focus on past and current work, showcasing actual results and ideally demonstrated beneficial effect on society, whereas the two page abstracts could highlight ideas that have not yet been applied in practice. These are designed to foster sharing different points of view ranging from the scientific assessment of feasibility, to discussion of practical constraints that may be encountered when they are deployed, also attracting interest from philanthropists invited to the event. The workshop provides a platform for developing these two page abstracts into real projects with a platform to connect with stakeholders, scientists, and funders.

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### Learning by Instruction

**Shashank Srivastava, Igor Labutov, Bishan Yang, Amos Azaria, Tom Mitchell**

**Sat Dec 08, 08:00 AM**

Machine Learning today is largely about automatically discovering patterns in large volumes of data. But as personal devices that interact with us in natural language become ubiquitous (e.g., Siri, Alexa, Google Now), and as computer perceptual abilities become more accurate, they open an exciting possibility of enabling end-users to teach machines similar to the way in which we teach one another. Natural language conversation, gesturing, demonstrating, teleoperating and other modes of communication offer a new paradigm for machine learning through instruction from humans. This paradigm both builds on several existing machine learning paradigms (e.g., active learning, supervised learning, reinforcement learning), and brings a unique set of advantages and research challenges that lie at the intersection of several fields including machine learning, natural language understanding, computer perception, and HCI. The aim of the proposed workshop is to bring together experts from these diverse fields to explore fundamental research questions in this new area, such as: (i) what is the fundamental nature of how people interact with machines when teaching them new knowledge, (ii) what novel machine learning models and algorithms are needed to learn from human instruction, and (iii) what are the practical considerations towards building practical systems that can learn from instruction?

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### NIPS 2018 Workshop on Meta-Learning

**Erin Grant, Frank Hutter, Sachin Ravi, Joaquin Vanschoren, Jane Wang**

**Sat Dec 08, 08:00 AM**

Recent years have seen rapid progress in meta-learning methods, which learn (and optimize) the performance of learning methods based on data, generate new learning methods from scratch, and learn to transfer knowledge across tasks and domains. Meta-learning can be seen as the logical conclusion of the arc that machine learning has undergone in the last decade, from learning classifiers, to learning representations, and finally to learning algorithms that themselves acquire representations and classifiers. The ability to improve one’s own learning capabilities through
experience can also be viewed as a hallmark of intelligent beings, and there are strong connections with work on human learning in neuroscience.

Meta-learning methods are also of substantial practical interest, since they have, e.g., been shown to yield new state-of-the-art automated machine learning methods, novel deep learning architectures, and substantially improved one-shot learning systems.

Some of the fundamental questions that this workshop aims to address are:
- What are the fundamental differences in the learning “task” compared to traditional “non-meta” learners?
- Is there a practical limit to the number of meta-learning layers (e.g., would a meta-meta-meta-learning algorithm be of practical use)?
- How can we design more sample-efficient meta-learning methods?
- How can we exploit our domain knowledge to effectively guide the meta-learning process?
- What are the meta-learning processes in nature (e.g., in humans), and how can we take inspiration from them?
- Which ML approaches are best suited for meta-learning, in which circumstances, and why?
- What principles can we learn from meta-learning to help us design the next generation of learning systems?

The goal of this workshop is to bring together researchers from all the different communities and topics that fall under the umbrella of meta-learning. We expect that the presence of these different communities will result in a fruitful exchange of ideas and stimulate an open discussion about the current challenges in meta-learning, as well as possible solutions.

In terms of prospective participants, our main targets are machine learning researchers interested in the processes related to understanding and improving current meta-learning algorithms. Specific target communities within machine learning include, but are not limited to: meta-learning, AutoML, reinforcement learning, deep learning, optimization, evolutionary computation, and Bayesian optimization. Our invited speakers also include researchers who study human learning, to provide a broad perspective to the attendees.

Integration of Deep Learning Theories

Richard Baraniuk, Anima Anandkumar, Stephane Mallat, Ankit B Patel, nh

Sat Dec 08, 08:00 AM

Deep learning has driven dramatic performance advances on numerous difficult machine learning tasks in a wide range of applications. Yet, its theoretical foundations remain poorly understood, with many more questions than answers. For example: What are the modeling assumptions underlying deep networks? How well can we expect deep networks to perform? When a certain network succeeds or fails, can we determine why and how? How can we adapt deep learning to new domains in a principled way? While some progress has been made recently towards a foundational understanding of deep learning, most theory work has been disjointed, and a coherent picture has yet to emerge. Indeed, the current state of deep learning theory is like the fable “The Blind Men and the Elephant”. The goal of this workshop is to provide a forum where theoretical researchers of all stripes can come together not only to share reports on their individual progress but also to find new ways to join forces towards the goal of a coherent theory of deep learning. Topics to be discussed include: - Statistical guarantees for deep learning models - Expressive power and capacity of neural networks - New probabilistic models from which various deep architectures can be derived - Optimization landscapes of deep networks - Deep representations and invariance to latent factors - Tensor analysis of deep learning - Deep learning from an approximation theory perspective - Sparse coding and deep learning - Mixture models, the EM algorithm, and deep learning In addition to invited and contributed talks by leading researchers from diverse backgrounds, the workshop will feature an extended poster/discussion session and panel discussion on which combinations of ideas are most likely to move theory of deep learning forward and which might lead to blind alleys.

Machine Learning for Health (ML4H): Moving beyond supervised learning in healthcare

Andrew Beam, Tristan Naumann, Marzyeh Ghassemi, Matthew McDermott, Madalina Filatera, Irene Y Chen, Brett Beaulieu-Jones, Mike Hughes, Farah Shamout, Corey Chivers, Jaz Kandola, Alexandre Yahi, Sam G Finlayson, Bruno Jedynak, Peter Schual, Natalia Antropova, Jason Fries

Sat Dec 08, 08:00 AM

Machine learning has had many notable successes within healthcare and medicine. However, nearly all such successes to date have been driven by supervised learning techniques. As a result, many other important areas of machine learning have been neglected and under appreciated in healthcare applications. In this workshop, we will convene a diverse set of leading researchers who are pushing beyond the boundaries of traditional supervised approaches. Attendees at the workshop will gain an appreciation for problems that are unique to healthcare and a better understanding of how machine learning techniques, including clustering, active learning, dimensionality reduction, reinforcement learning, causal inference, and others, may be leveraged to solve important clinical problems. This year’s program will also include spotlight presentations and two poster sessions highlighting novel research contributions at the intersection of machine learning and healthcare. We will invite submission of two page abstracts (not including references) for poster contributions. Topics of interest include but are not limited to models for diseases and clinical data, temporal models, Markov decision processes for clinical decision support, multiscale data-integration, modeling with missing or biased data, learning with non-stationary data, uncertainty and uncertainty propagation, non i.i.d. structure in the data, critique of models, interpretable models, causality, model biases, transfer learning, and incorporation of non-clinical (e.g., socioeconomic) factors. The broader goal of the NIPS 2018 Machine Learning for Health Workshop (ML4H) is to foster collaborations that meaningfully impact medicine by bringing together clinicians, health data experts, and machine learning researchers. Attendees at this workshop can also expect to broaden their network of collaborators to include clinicians and machine learning researchers who are focused on solving some of the most important problems in medicine and healthcare.
Machine Learning for Systems

Anna Goldie, Azalia Mirhoseini, Jonathan Raiman, Kevin Swersky, Milad Hashemi

Sat Dec 08, 08:00 AM

The Machine Learning for Systems workshop is focused on developing machine learning methods to optimize system design. Designing specialized hardware and systems for deep learning is a topic that has received significant research attention, both in industrial and academic settings, leading to exponential increases in compute capability in GPUs and accelerators. However, using machine learning to optimize and accelerate software and hardware systems is a lightly explored but promising field, with broad implications for computing as a whole. Very recent work has outlined a broad scope where deep learning vastly outperforms traditional heuristics, including topics such as: scheduling [1], data structure design [2], microarchitecture [3], compilers [4], and control of warehouse scale computing systems [5]. The focus of this workshop is to expand upon this recent work and build a community focused on using machine learning in computer systems problems. We seek to improve the state of the art in the areas where learning has already proven to perform better than traditional heuristics, as well as expand to new areas throughout the system stack such as hardware/circuit design and operating/runtime systems. By forming a community of academic and industrial researchers who are excited about this area, we see to build towards intelligent, self optimizing systems and answer questions such as: How do we generate and share high quality datasets that span the layers of the system stack? Which learned representations best represent code performance and runtime? Which simulators and simulation methodologies provide a tractable proving ground for techniques like reinforcement learning? To this end, the target audience for this workshop includes a wide variety of attendees from state-of-the-art researchers in machine learning to domain experts in computer systems design. We have invited a broad set of expert speakers to present the potential for impact of combining machine learning research with computer systems. We hope that providing a formal venue for researchers from both fields to meet and interact will push forward both fundamental research in ML as well as real-world impact to computer systems design and implementation. The workshop will host 6 speakers/panelists (all confirmed) and we will put out a call for researchers to submit relevant papers, up to 4 pages in the default NIPS style, that will undergo a peer review process. Selected works will be presented as spotlights, contributed talks and/or posters. Speakers will be invited to participate in an interactive panel discussion to conclude the workshop. This workshop is part two of a two-part series with one day focusing on Machine Learning for Systems and the other on Systems for Machine Learning. Although the two workshops are being led by different organizers, we are coordinating our call for papers to ensure that the workshops complement each other and that submitted papers are routed to the appropriate venue. The Systems for Machine Learning workshop focuses on designing systems to enable ML, whereas we focus on developing ML to optimize systems. Both fields are mature enough to warrant a dedicated workshop. Organizers on both sides are open to merging in the future, but this year we plan to run them separately on two different days. The organizers of this workshop span core research in machine learning, computer systems and architecture, as well as their intersection. Jointly, they have published in top-tier systems and machine learning conferences including: NIPS, ICML, ICLR, ISCA, MICRO, DAC, and SIGMETRICS. References: [1] Device Placement Optimization with Reinforcement Learning, https://arxiv.org/pdf/1706.04972.pdf [2] The Case for Learned Index Structures, https://arxiv.org/abs/1712.01208 [3] Learning Memory Access Patterns, https://arxiv.org/pdf/1803.02329.pdf [4] End to End Deep Learning of Optimization Heuristics: https://ieeexplore.ieee.org/document/8091247/?reload=true [5] https://deeppmind.com/blog/deeppmind-ai-reduces-google-data-centre-cooling-bill-40/ [6] Bayesian optimization for tuning the JVM, https://www.youtube.com/watch?v=YhN468SSSIC [7] Safe Exploration for Identifying Linear Systems via Robust Optimization: https://arxiv.org/abs/1711.11165

NIPS Workshop on Machine Learning for Intelligent Transportation Systems 2018

Li Erran Li, Anca Dragan, Juan Carlos Niebles, Silvio Savarese

Sat Dec 08, 08:00 AM

Our transportation systems are poised for a transformation as we make progress on autonomous vehicles, vehicle-to-vehicle (V2V) and vehicle-to-everything (V2X) communication infrastructures, and smart road infrastructures (like smart traffic lights). But many challenges stand in the way of this transformation. For example, how do we make perception accurate and robust enough to accomplish safe autonomous driving? How do we generate policies that equip autonomous cars with adaptive human negotiation skills when merging, overtaking, or yielding? How do we decide when a system is safe enough to deploy? And how do we optimize efficiency through intelligent traffic management and control of fleets?

To meet these requirements in safety, efficiency, control, and capacity, the systems must be automated with intelligent decision making. Machine learning will be an essential component of that. Machine learning has made rapid progress in the self-driving domain (e.g., in real-time perception and prediction of traffic scenes); has started to be applied to ride-sharing platforms such as Uber (e.g., demand forecasting); and by crowd-sourced video scene analysis companies such as Nexar (e.g., understanding and avoiding accidents). But to address the challenges arising in our future transportation system, we need to consider the transportation systems as a whole rather than solving problems in isolation, from prediction, to behavior, to infrastructure.

The goal of this workshop is to bring together researchers and practitioners from all areas of intelligent transportations systems to address core challenges with machine learning. These challenges include, but are not limited to pedestrian detection, intent recognition, and negotiation, coordination with human-driven vehicles, machine learning for object tracking, unsupervised representation learning for autonomous driving, deep reinforcement learning for learning driving policies, cross-modal and simulator to real-world transfer learning, scene classification, real-time perception and prediction of traffic scenes, uncertainty propagation in deep neural networks, efficient inference with deep neural networks, predictive modeling of risk and accidents through telematics, modeling, simulation and forecast of demand and mobility patterns in large scale urban transportation systems, machine learning approaches for control and coordination of traffic...
leveraging V2V and V2X infrastructures,

The workshop will include invited speakers, panels, presentations of accepted papers, and posters. We invite papers in the form of short, long, and position papers to address the core challenges mentioned above. We encourage researchers and practitioners on self-driving cars, transportation systems and ride-sharing platforms to participate.

This is the 3rd NIPS workshop in this series. Previous workshops have been very successful and have attracted large numbers of participants from both academia and industry.

**Schedule**

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<tr>
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<tr>
<td>09:00 AM</td>
<td>Invited talk: Vladlen Koltun, Intel</td>
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<td>09:30 AM</td>
<td>Invited Talk: Drew Bagnell, CMU and Aurora</td>
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<td>10:00 AM</td>
<td>Invited Talk: Alex Bayen, UC Berkeley</td>
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<td>Coffee break: morning</td>
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<td>11:00 AM</td>
<td>Invited Talk: Nathaniel Fairfield, Waymo</td>
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<td>02:00 PM</td>
<td>Invited Talk: Marco Pavone, Stanford</td>
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<td>03:00 PM</td>
<td>Coffee break: afternoon</td>
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<td>Invited Talk: Ingmar Posner, Oxford</td>
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<td>04:00 PM</td>
<td>Invited Talk: Dorsa Sadigh, Stanford</td>
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<td>04:30 PM</td>
<td>Invited Talk: Ekaterina Tarlova, Zoox</td>
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**Machine Learning for Molecules and Materials**

*Jose Miguel Hernández-Lobato, Klaus-Robert Müller, Brooks Paige, Matt Kusner, Stefan Chmiela, Kristof Schütt*

**Sat Dec 08, 08:00 AM**

The success of machine learning has been demonstrated time and time again in classification, generative modelling, and reinforcement learning. This revolution in machine learning has largely been in domains with at least one of two key properties: (1) the input space is continuous, and thus classifiers and generative models are able to smoothly model unseen data that is “similar” to the training distribution, or (2) it is trivial to generate data, such as in controlled reinforcement learning settings such as Atari or Go games, where agents can re-play the game millions of times. Unfortunately there are many important learning problems in chemistry, physics, materials science, and biology that do not share these attractive properties, problems where the input is molecular or material data. Accurate prediction of atomistic properties is a crucial ingredient toward rational compound design in chemical and pharmaceutical industries. Many discoveries in chemistry can be guided by screening large databases of computational molecular structures and properties, but high level quantum-chemical calculations can take up to several days per molecule or material at the required accuracy, placing the ultimate achievement of in silico design out of reach for the foreseeable future. In large part the current state of the art for such problems is the expertise of individual researchers or at best highly-specific rule-based heuristic systems. Efficient methods in machine learning, applied to the prediction of atomistic properties as well as compound design and crystal structure prediction, can therefore have pivotal impact in enabling chemical discovery and foster fundamental insights. Because of this, in the past few years there has been a flurry of recent work towards designing machine learning techniques for molecule and material data [1-38]. These works have drawn inspiration from and made significant contributions to areas of machine learning as diverse as learning on graphs to models in natural language processing. Recent advances enabled the acceleration of molecular dynamics simulations, contributed to a better understanding of interactions within quantum many-body system and increased the efficiency of density based quantum mechanical modeling methods. This young field offers unique opportunities for machine learning researchers and practitioners, as it presents a wide spectrum of challenges and open questions, including but not limited to representations of physical systems, physically constrained models, manifold learning, interpretability, model bias, and causality. The goal of this workshop is to bring together researchers and industrial practitioners in the fields of computer science, chemistry, physics, materials science, and biology all working to innovate and apply machine learning to tackle the challenges involving molecules and materials. In a highly interactive format, we will outline the current frontiers and present emerging research directions. We aim to use this workshop as an opportunity to establish a common language between all communities, to actively discuss new research problems, and also to collect datasets by which novel machine learning models can be benchmarked. The program is a collection of invited talks, alongside contributed posters. A panel discussion will provide different perspectives and experiences of influential researchers from both fields and also engage open participant conversation. An expected outcome of this workshop is the interdisciplinary exchange of ideas and initiation of collaboration. Call for papers: The 1 day NIPS 2018 Workshop on Machine Learning for Molecules and Materials is calling for contributions on theoretical models, empirical studies, and applications of machine learning for molecules and materials. We also welcome challenge papers on possible applications or datasets. Topics of interest (though not exhaustive) include: chemoinformatics, applications of deep learning to predict molecular properties, drug-discovery and material design, retrosynthesis and synthetic route prediction, modeling and prediction of chemical reaction data, and the analysis of molecular dynamics simulations. We invite submissions that either address new problems and insights for chemistry and quantum physics or present progress on established problems. The workshop includes a poster session, giving the opportunity to present novel ideas and ongoing projects. Submissions should be no longer than 10 pages in any format. Please email all submissions to: nips2018moleculesworkshop@gmail.com

References

Relational Representation Learning

Aditya Grover, Paroma Varma, Fred Sala, Steven Holtzen, Jennifer Neville, Stefano Ermon, Chris Ré

Sat Dec 08, 08:00 AM

Relational reasoning, \textit{i.e.}, learning and inference with relational data, is key to understanding how objects interact with each other and give rise to complex phenomena in the everyday world. Well-known applications include knowledge base completion and social network analysis. Although many relational datasets are available, integrating them directly into modern machine learning algorithms and systems that rely on continuous, gradient-based optimization and make strong i.i.d. assumptions is challenging. Relational representation learning has the potential to overcome these obstacles: it enables the fusion of recent advancements like deep learning and relational reasoning to learn from high-dimensional data. Success of such methods can facilitate novel applications of relational reasoning in areas like scene understanding, visual question-answering, reasoning over chemical and biological domains, program synthesis and analysis, and decision-making in multi-agent systems.

How should we rethink classical representation learning theory for relational representations? Classical approaches based on dimensionality reduction techniques such as isoMap and spectral decompositions still serve as strong baselines and are slowly paving the way for modern methods in relational representation learning based on random walks over graphs, message-passing in neural networks,
Our objectives include bringing together potential partners to organize new impactful challenges. Axes: (1) Design principles and implementation issues; (2) Opportunities in the real world, by interacting with the environment. But organizing into an intelligent conversation. Applications are countless for machine learning to run challenge, an reinforcement learning challenge in which a navigation, which accelerated research on autonomous vehicles, leading relatively recently is the DARPA grant challenge 2005 on autonomous reduction techniques, group-invariant architectures etc. amongst many others. How can policy search space and shape the optimization landscape. Intrinsic and self-supervised signals can further guide the training process of distinct policy approaches for avoiding prohibitive amounts of controller–system interactions. These methods leverage informative priors on useful behavior, as well as controller structure such as hierarchy and modularity, as useful inductive biases that reduce the effective size of policy search space and shape the optimization landscape. Intrinsic and self-supervised signals can further guide the training process of distinct internal components — such as perceptual embeddings, predictive models, exploration policies, and inter-agent communication — to break down the hard holistic problem of control into more efficiently learnable parts. Effective inference methods are crucial for probabilistic approaches to reinforcement learning and structured control. Approximate control and model-free reinforcement learning exploit latent system structure and priors on policy structure, that are not directly evident in the controller–system interactions, and must be inferred by the learning algorithm. The growing interest of the reinforcement learning and optimal control community in the application of inference methods is synchronized well with the development by the probabilistic learning community of powerful inference techniques, such as probabilistic programming, variational inference, Gaussian processes, and nonparametric regression. This workshop is a venue for the inference and reinforcement learning communities to come together in discussing recent advances, developing insights, and future potential in inference methods and their application to probabilistic reinforcement learning and organization of challenges for the benefit of society.

This workshop aims to bring together researchers from both academia and industry interested in addressing various aspects of representation learning for relational reasoning. Topics include, but are not limited to:

* Algorithmic approaches. E.g., probabilistic generative models, message-passing neural networks, embedding methods, dimensionality reduction techniques, group-invariant architectures etc. for relational data
* Theoretical aspects. E.g., when and why do learned representations aid relational reasoning? How does the non-i.i.d. nature of relational data conflict with our current understanding of representation learning?
* Optimization and scalability challenges due to the inherent discreteness and curse of dimensionality of relational datasets
* Evaluation of learned relational representations
* Security and privacy challenges
* Domain-specific applications
* Any other topic of interest

CiML 2018 - Machine Learning competitions "in the wild": Playing in the real world or in real time

Isabelle Guyon, Evelyne Viegas, Sergio Escalera, Jacob D Abernethy

Sat Dec 08, 08:00 AM

Challenges in machine learning and data science are competitions running over several weeks or months to resolve problems using provided datasets or simulated environments. The playful nature of challenges naturally attracts students, making challenge a great teaching resource. For this fifth edition of the CiML workshop at NIPS we want to go beyond simple data science challenges using canned data. We will explore the possibilities offered by challenges in which code submitted by participants are evaluated "in the wild", directly interacting in real time with users or with real or simulated systems. Organizing challenges "in the wild" is not new. One of the most impactful such challenge organized relatively recently is the DARPA grant challenge 2005 on autonomous navigation, which accelerated research on autonomous vehicles, leading to self-driving cars. Other high profile challenge series with live competitions include RoboCup, which has been running from the past 22 years. Recently, the machine learning community has started being interested in such interactive challenges, with last year at NIPS the learning to run challenge, an reinforcement learning challenge in which a human avatar had to be controlled with simulated muscular contractions, and the ChatBot challenge in which humans and robots had to engage into an intelligent conversation. Applications are countless for machine learning and artificial intelligence programs to solve problems in real time in the real world, by interacting with the environment. But organizing such challenges is far from trivial

The workshop will give a large part to discussions around two principal axes: (1) Design principles and implementation issues; (2) Opportunities to organize new impactful challenges. Our objectives include bringing together potential partner to organize new such challenges and stimulating "machine learning for good", i.e. the

Infer to Control: Probabilistic Reinforcement Learning and Structured Control

Leslie Kaelbling, Martin Riedmiller, Marc Toussaint, Igor Mordatch, Roy Fox, Tuomas Haarnoja

Sat Dec 08, 08:00 AM

Reinforcement learning and imitation learning are effective paradigms for learning controllers of dynamical systems from experience. These fields have been empowered by recent success in deep learning of differentiable parametric models, allowing end-to-end training of highly nonlinear controllers that encompass perception, memory, prediction, and decision making. The aptitude of these models to represent latent dynamics, high-level goals, and long-term outcomes is unfortunately curbed by the poor sample complexity of many current algorithms for learning these models from experience. Probabilistic reinforcement learning and inference of control structure are emerging as promising approaches for avoiding prohibitive amounts of controller–system interactions. These methods leverage informative priors on useful behavior, as well as controller structure such as hierarchy and modularity, as useful inductive biases that reduce the effective size of policy search space and shape the optimization landscape. Intrinsic and self-supervised signals can further guide the training process of distinct internal components — such as perceptual embeddings, predictive models, exploration policies, and inter-agent communication — to break down the hard holistic problem of control into more efficiently learnable parts. Effective inference methods are crucial for probabilistic approaches to reinforcement learning and structured control.
structured control. The goal of this workshop is to catalyze tighter collaboration within and between the communities, that will be leveraged in upcoming years to rise to the challenges of real-world control problems.

Emergent Communication Workshop

Jakob Foerster, Angeliki Lazaridou, Ryan Lowe, Igor Mordatch, Douwe Kiela, Kyunghyun Cho

Sat Dec 08, 08:00 AM

Abstract Communication is one of the most impressive human abilities. The question of how communication arises has been studied for many decades, if not centuries. However, due to computational and representational limitations, past work was restricted to low dimensional, simple observation spaces. With the rise of deep reinforcement learning methods, this question can now be studied in complex multi-agent settings, which has led to flourishing activity in the area over the last two years. In these settings agents can learn to communicate in grounded multi-modal environments and rich communication protocols emerge. Last year at NIPS 2017 we successfully organized the inaugural workshop on emergent communication (https://sites.google.com/site/ememcom2017). We had a number of interesting submissions looking into the question of how language can emerge using evolution (see this Nature paper that was also presented at the workshop last year, https://www.nature.com/articles/srep34615) and under what conditions emerged language exhibits compositional properties, while others explored specific applications of agents that can communicate (e.g., answering questions about textual inputs, a paper presented by Google that was subsequently accepted as an oral presentation at ICLR this year, etc.). While last year’s workshop was a great success, there are a lot of open questions. In particular, the more challenging and realistic use cases come from situations where agents do not have fully aligned interests and goals, i.e., how can we have credible communication amongst self-interested agents where each agent maximizes its own individual rewards rather than a joint team reward? This is a new computational modeling challenge for the community and recent preliminary results (e.g. “Emergent Communication through Negotiation”, Cao et al., ICLR 2018.) reinforce the fact that it is no easy feat. Since machine learning has exploded in popularity recently, there is a tendency for researchers to only engage with recent machine learning literature, therefore at best reinventing the wheel and at worst recycling the same ideas over and over, increasing the probability of being stuck in local optima. For these reasons, just like last year, we want to take an interdisciplinary approach on the topic of emergent communication, inviting researchers from different fields (machine learning, game theory, evolutionary biology, linguistics, cognitive science, and programming languages) interested in the question of communication and emergent language to exchange ideas. This is particularly important for this year’s focus, since the question of communication in general-sum settings has been an active topic of research in game theory and evolutionary biology for a number of years, while it’s a nascent topic in the area of machine learning.

Interpretability and Robustness in Audio, Speech, and Language

Mirco Ravanelli, Dmitrij Serdyuk, Ehsan Variani, Bhuvana Ramabhadran

Sat Dec 08, 08:00 AM

Domains of natural and spoken language processing have a rich history deeply rooted in information theory, statistics, digital signal processing and machine learning. With the rapid rise of deep learning (“deep learning revolution”), many of these systematic approaches have been replaced by variants of deep neural methods, that often achieve unprecedented performance levels in many fields. With more and more of the spoken language processing pipeline being replaced by sophisticated neural layers, feature extraction, adaptation, noise robustness are learnt inherently within the network. More recently, end-to-end frameworks that learn a mapping from speech (audio) to target labels (words, phones, graphemes, sub-word units, etc.) are becoming increasingly popular across the board in speech processing in tasks ranging from speech recognition, speaker identification, language/dialect identification, multilingual speech processing, code switching, natural language processing, speech synthesis and much much more.

A key aspect behind the success of deep learning lies in the discovered low and high-level representations, that can potentially capture relevant underlying structure in the training data. In the NLP domain, for instance, researchers have mapped word and sentence embeddings to semantic and syntactic similarity and argued that the models capture latent representations of meaning. Nevertheless, some recent works on adversarial examples have shown that it is possible to easily fool a neural network (such as a speech recognizer or a speaker verification system) by just adding a small amount of specially constructed noise. Such a remarkable sensibility towards adversarial attacks highlights how superficial the discovered representations could be, rising crucial concerns on the actual robustness, security, and interpretability of modern deep neural networks. This weakness naturally leads researchers to ask very crucial questions on what these models are really learning, how we can interpret what they have learned, and how the representations provided by current neural networks can be revealed or explained in a fashion that modeling power can be enhanced further. These open questions have recently raised the interest towards interpretability of deep models, as witness by the numerous works recently published on this topic in all the major machine learning conferences. Moreover, some workshops at NIPS 2016, NIPS 2017 and Interspeech 2017 have promoted research and discussion around this important issue. With our initiative, we wish to further foster some progresses on interpretability and robustness of modern deep learning techniques, with a particular focus on audio, speech and NLP technologies. The workshop will also analyze the connection between deep learning and models developed earlier for machine learning, linguistic analysis, signal processing, and speech recognition. This way we hope to encourage a discussion amongst experts and practitioners in these areas with the expectation of understanding these models better and allowing to build upon the existing collective expertise.

The workshop will feature invited talks, panel discussions, as well as oral and poster contributed presentations. We welcome papers that specifically address one or more of the leading questions listed below:
1. Is there a theoretical/linguistic motivation/analysis that can explain how nets encapsulate the structure of the training data it learns from?
2. Does the visualization of this information (MDS, t-SNE) offer any
insights to creating a better model?
3. How can we design more powerful networks with simpler architectures?
4. How can we exploit adversarial examples to improve the system robustness?
5. Do alternative methods offer any complimentary modeling power to what the networks can memorize?
6. How can we explain the path of inference?
7. How do we analyze data requirements for a given model? How does multilingual data improves learning power?

### Schedule

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<tr>
<td>08:45 AM</td>
<td>Workshop Opening</td>
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<tr>
<td>09:00 AM</td>
<td>Invited Speaker 1</td>
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<td>Contributed Talks 1</td>
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<td>Coffee break + posters 1</td>
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<td>05:00 PM</td>
<td>Panel Discussion</td>
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<td>Workshop Closing</td>
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### Machine Learning Open Source Software 2018: Sustainable communities

**Heiko Strathmann, Viktor Gal, Ryan R. Curtin, Sergey Lisitsyn, Antti Honkela, Cheng Soon Ong**

**Sat Dec 08, 08:00 AM**

Machine learning open source software (MLOSS) is one of the cornerstones of open science and reproducible research. Once a niche area for ML research, MLOSS today has gathered significant momentum, fostered both by scientific community, and more recently by corporate organizations. Along with open access and open data, it enables free reuse and extension of current developments in ML. The past mloss.org workshops at NIPS06, NIPS08, ICML10, NIPS13, and ICML15 successfully brought together researchers and developers from both fields, to exchange experiences and lessons learnt, to encourage interoperability between people and projects, and to demonstrate software to users in the ML community.

Continuing the tradition in 2018, we plan to have a workshop that is a mix of invited speakers, contributed talks and discussion/activity sessions. This year’s headline aims to give an insight of the challenges faced by projects as they seek long-term sustainability, with a particular focus on community building and preservation, and diverse teams. In the talks, we will cover some of the latest technical innovations as done by established and new projects. The main focus, however, will be on insights on project sustainability, diversity, funding and attracting new developers, both from academia and industry. We will discuss various strategies that helps promoting gender diversity in projects (e.g. implementing quotas etc.) and how to promote developer growth within a project.

We aim to make this workshop as diverse as possible within the field. This includes a gender balanced speakers, focussing on programming languages from different scientific communities, and in particular most of our invited speakers represent umbrella projects with a hugely diverse set of applications and users (NumFOCUS, openML, tidyverse).

With a call for participation for software project demos, we aim to provide improved outreach and visibility, especially for smaller OSS projects as typically present in academia. In addition, our workshop will serve as a gathering of OSS developers in academia, for peer to peer exchange of learnt lessons, experiences, and sustainability and diversity tactics.

The workshop will include an interactive session to produce general techniques for driving community engagement and sustainability, such as application templates (Google Summer of Code, etc), “getting started” guides for new developers, and a collection of potential funding sources. We plan to conclude the workshop with a discussion on the headline topic.

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### Second Workshop on Machine Learning for Creativity and Design

**Luba Elliott, Sander Dieleman, Rebecca Fiebrink, Jesse Engel, Adam Roberts, Tom White**

**Sat Dec 08, 08:00 AM**

Over the past few years, generative machine learning and machine creativity have continued grow and attract a wider audience to machine learning. Generative models enable new types of media creation across images, music, and text - including recent advances such as sketch-rnn and the Universal Music Translation Network. This one-day workshop broadly explores issues in the applications of machine learning to creativity and design. We will look at algorithms for generation and creation of new media and new designs, engaging researchers building the next generation of generative models (GANs, RL, etc). We investigate the social and cultural impact of these new models, engaging researchers from HCI/UX communities and those using machine learning to develop new creative tools. In addition to covering the technical advances, we also address the ethical concerns ranging from the use of biased datasets to building tools for better “DeepFakes”. Finally, we’ll hear from some of the artists and musicians who are adopting machine learning including deep learning and reinforcement learning as part of
their own artistic process. We aim to balance the technical issues and challenges of applying the latest generative models to creativity and design with philosophical and cultural issues that surround this area of research. Background In 2016, DeepMind’s AlphaGo made two moves against Lee Sedol that were described by the Go community as “brilliant,” “surprising,” “beautiful,” and so forth. Moreover, there was little discussion surrounding the fact that these very creative moves were actually made by a machine; it was enough that they were great examples of go playing. At the same time, the general public showed more concern for other applications of generative models. Algorithms that allow for convincing voice style transfer (Lyrebird) or puppet-like video face control (Face2Face) have raised ethical concerns that generative ML will be used to make convincing forms of fake news. Balancing this, the arts and music worlds have positively embraced generative models. Starting with DeepDream and expanding with image and video generation advances (e.g., GANs) we’ve seen lots of new and interesting art and music technologies provided by the machine learning community. We’ve seen research projects like Google Brain’s Magenta, Sony CSL’s FlowMachines and IBM’s Watson undertake collaborations and attempt to build tools and ML models for use by these communities.

Research Recent advances in generative models enable new possibilities in art and music production. Language models can be used to write science fiction film scripts (Sunspring), theatre plays (Beyond the Fence) and even replicate the style of individual authors (Deep Tingle). Generative models for image and video allow us to create visions of people, places and things that resemble the distribution of actual images (GANs etc.). Sequence modelling techniques have opened up the possibility of generating realistic musical scores (MIDI generation etc.) and even raw audio that resembles human speech and physical instruments (DeepMind’s WaveNet, MLA’s Char2Wav and Google’s NSynth). In addition, sequence modelling allows us to model vector images to construct stroke-based drawings of common objects according to human doodles (sketch-mn). Lately, domain transfer techniques (FAIR’s Universal Music Translation Network) have enabled the translation of music across musical instruments, genres, and styles. In addition to field-specific research, a number of papers have come out that are directly applicable to the challenges of generation and evaluation such as learning from human preferences (Christiano et al., 2017) and CycleGAN. The application of Novelty Search (Stanley), evolutionary complexification (Stanley - CPPN, NEAT, Nguyen et al - Plug&Play GANs, Innovation Engine) and intrinsic motivation (Oudeyer et al 2007, Schmidhuber on Fun and Creativity) techniques, where objective functions are constantly evolving, is still not common practice in art and music generation using machine learning. Another focus of the workshop is how to better enable human influence over generative models. This could include learning from human preferences, exposing model parameters in ways that are understandable and relevant to users in a given application domain (e.g., similar to Morris et al. 2008), enabling users to manipulate models through changes to training data (Fiebrink et al. 2011), allowing users to dynamically mix between multiple generative models (Akten & Grierson 2016), or other techniques. Although questions of how to make learning algorithms controllable and understandable to users are relatively nascent in the modern context of deep learning and reinforcement learning, such questions have been a growing focus of work within the human-computer interaction community (e.g., examined in a CHI 2016 workshop on Human-Centred Machine Learning), and the AI Safety community (e.g. Christiano et al. 22017, using human preferences to train deep reinforcement learning systems). Such considerations also underpin the new Google “People + AI Research” (PAIR) initiative. Artists and Musicians All the above techniques improve our capabilities of producing text, sound and images and have helped popularise the themes of machine learning and artificial intelligence in the art world with a number of art exhibitions (ZKM’s Open Codes, Frankfurter Kunstverein’s I am here to learn, NRW Forum’s Pendoran Vinci) and media art festivals (Impakt Festival 2018 Algorithmic Superstructures, Retune 2016) dedicated to the topic. Art and music that stands the test of time however requires more than generative capabilities. Recent research includes a focus on novelty in creative adversarial networks (Elgammal et al., 2017) and considers how generative algorithms can integrate into human creative processes, supporting exploration of new ideas as well as human influence over generated content (Atken & Grierson 2016a, 2016b). Artists including Mario Klingemann, Roman Lipski, Mike Tyka, and Memo Akten have further contributed to this space of work by creating artwork that compellingly demonstrates capabilities of generative algorithms, and by publicly reflecting on the artistic affordances of these new tools. Other artists such as Mimi Onouha, Caroline Sinders, and Adam Harvey have explored the ethical dimensions of machine learning technologies, reflecting on the issues of biased datasets and facial recognition. The goal of this workshop is to bring together researchers interested in advancing art and music generation to present new work, foster collaborations and build networks. In this workshop, we are particularly interested in how the following can be used in art and music generation: reinforcement learning, generative adversarial networks, novelty search and evaluation as well as learning from user preferences. We welcome submissions of short papers, demos and extended abstracts related to the above. Like last year, there will be an open call for a display of artworks incorporating machine learning techniques. The exhibited works serve as a separate and more personal forum for collecting and sharing some of the latest creative works incorporating machine learning techniques with the NIPS community.

**Schedule**

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<th>Time</th>
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<tr>
<td>08:45 AM</td>
<td>Kenneth Stanley</td>
<td>Medical Imaging meets NIPS</td>
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**Medical Imaging meets NIPS**

Ender Konukoglu, Ben Glover, Hervé Lombaert, Marleen de Brujline

Sat Dec 08, 08:00 AM

### Scope **Medical Imaging meets NIPS**

NIPS ([https://sites.google.com/view/med-nips-2018](https://sites.google.com/view/med-nips-2018)) is a new satellite workshop established in 2017. The workshop aims to bring researchers together from the medical image computing and machine learning communities.** The objective is to discuss the major challenges in the field and opportunities for joining forces. This year the workshops will feature an **oral and poster session** where accepted works are presented. In addition, there will be **a series of high-profile invited speakers** from industry, academia, engineering and medical sciences giving an overview of recent advances, challenges, latest technology and efforts for sharing clinical data. **Motivation** Medical imaging is facing a major crisis with an ever increasing complexity and volume of data and immense economic pressure. The interpretation of medical images pushes human abilities to the limit with the risk that critical patterns of disease go undetected. Machine learning has emerged as a key technology for developing novel tools in computer aided diagnosis,
therapy and intervention. Still, progress is slow compared to other fields of visual recognition which is mainly due to the domain complexity and constraints in clinical applications which require most robust, accurate, and reliable solutions. ### Call for Abstracts We invite **[submissions of extended abstracts](https://sites.google.com/view/med-nips-2018/submissions)** for oral and poster presentation during the workshop. **Submitting an abstract is an ideal way of engaging with the workshop and to showcase research in the area of machine learning for medical imaging**. Submitted work does not have to be original and can be already published elsewhere and/or can be of preliminary nature. There will be no workshop proceedings, but accepted abstracts together with author information will be made available on this website. ### Dates - Submissions: **Monday, October 15th, 23:59 PST** - Notifications: Wednesday, October 31st - Workshop: Saturday, December 8th ### Organizers - Ender Konukoglu (ETH Zurich, Switzerland) - Hervé Lombaert (ETS Montreal – Inria, Canada) - Ben Glocker (Imperial College London, UK) - Marleen de Bruijne (Erasmus MC, Rotterdam, The Netherlands) ### Website [https://sites.google.com/view/med-nips-2018](https://sites.google.com/view/med-nips-2018) ### Contact Email: [ender.konukoglu@vision.ee.ethz.ch](mailto:ender.konukoglu@vision.ee.ethz.ch)