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“Studying How to Efficiently and Effectively Guide Models with Explanations” – A Reproducibility Study

Adrian Sauter, Milan Miletić, Ryan Ott, Pemmasani Prabakaran Rohith Saai

NeurIPS 2024

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"Studying How to Efficiently and Effectively Guide Models with Explanations" – A Reproducibility Study

Rao et al. (2023)

Adrian Sauter, Milan Miletić, Ryan Ott, Pemmasani Prabakaran Rohith Saai

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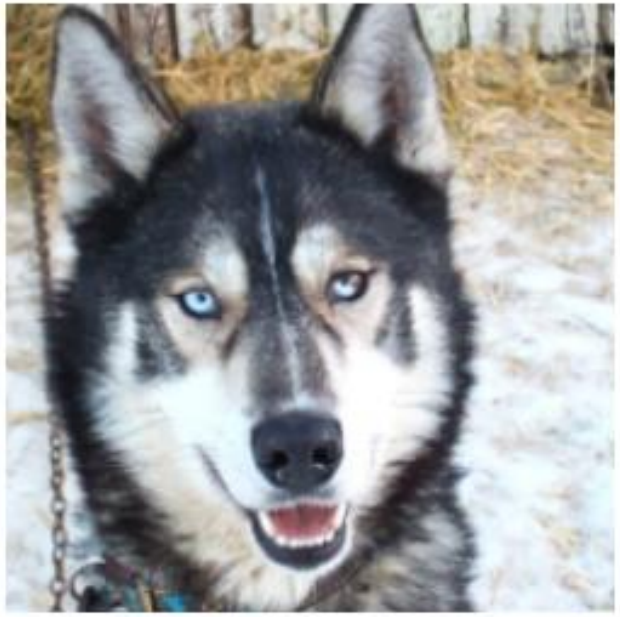
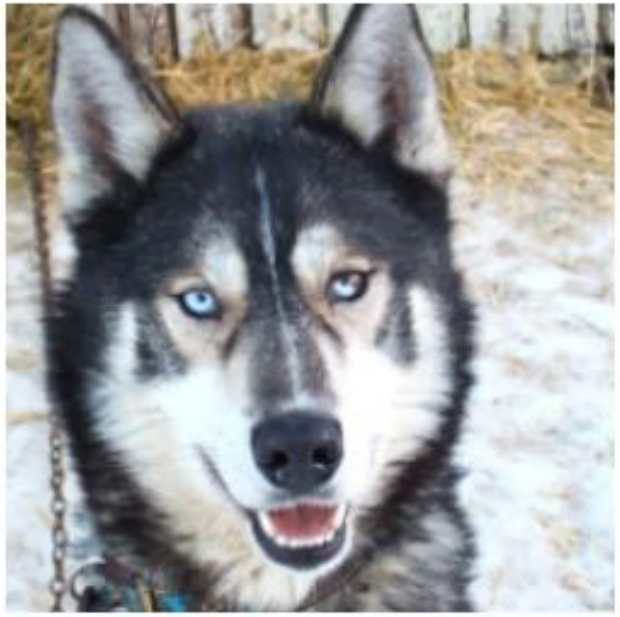
Motivation



Husky classified as a wolf

[1] “Why Should I Trust You?” Explaining the Predictions of Any Classifier, Ribeiro et al. (2016)

Motivation



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Explanation

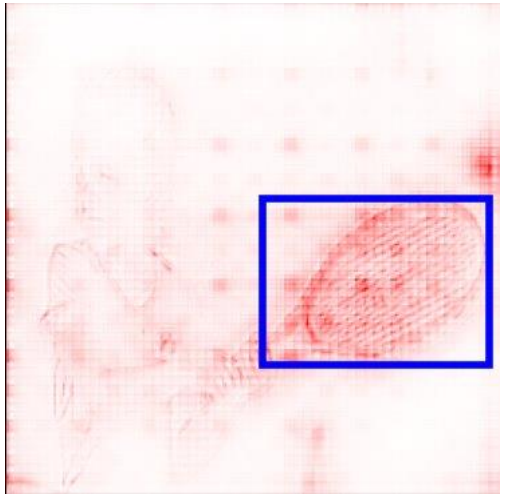
[1] “Why Should I Trust You?” Explaining the Predictions of Any Classifier, Ribeiro et al. (2016)

Model Guidance

- Ensuring models are “right for the right reasons”

Tennis racket

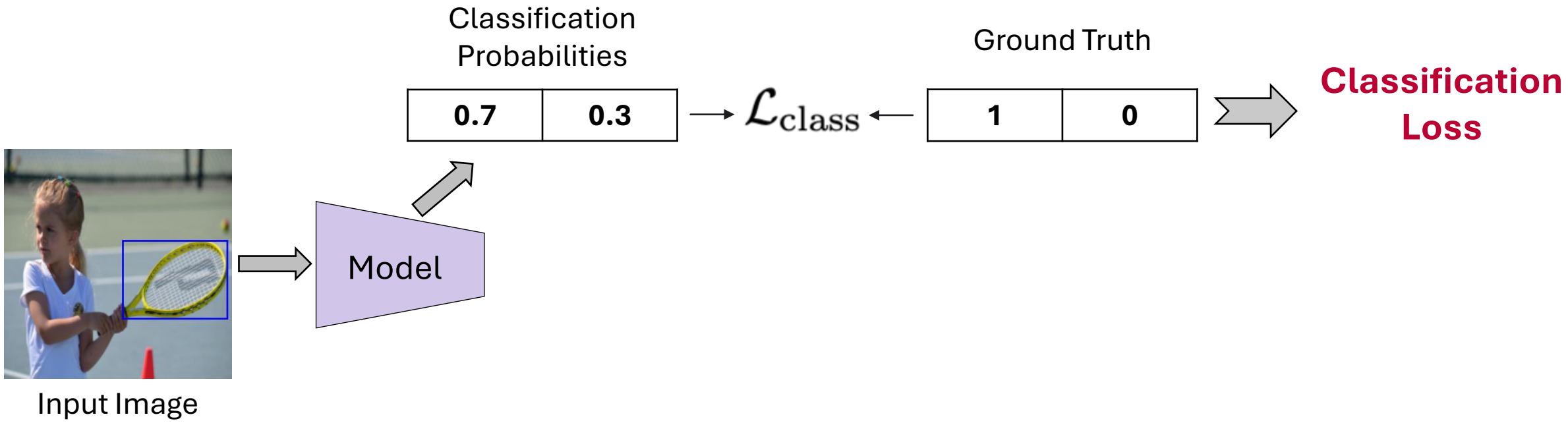
Input Image



Attribution Map

[2] Studying How to Effectively and Efficiently Guide Models with Explanations, Rao et al. (2023)

Methodology (Rao et al., 2023)



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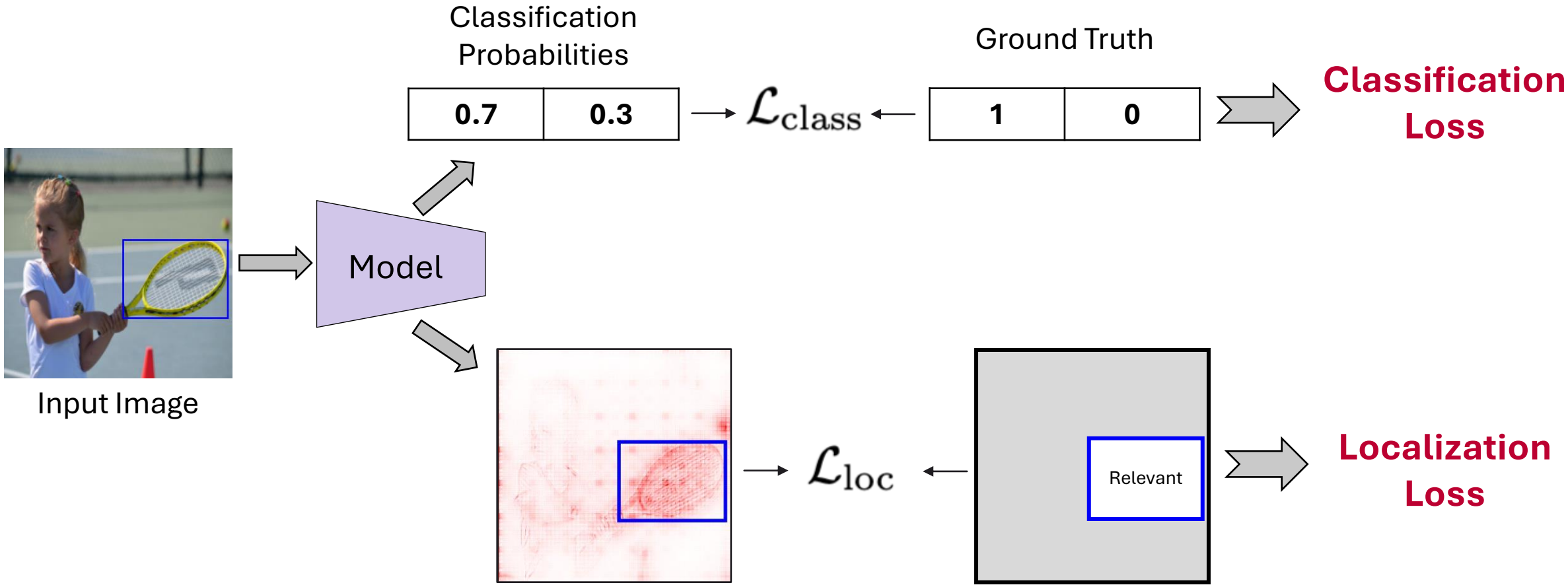

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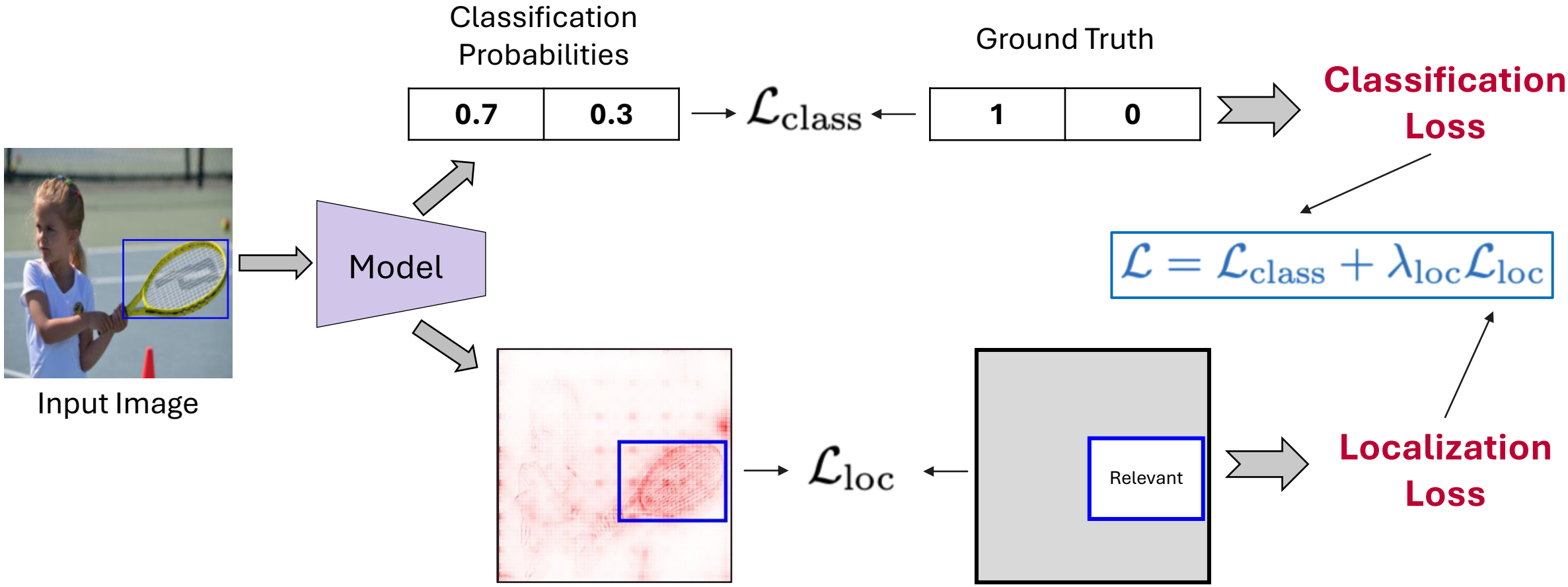
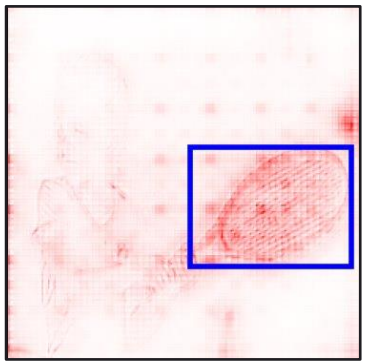


[2] Studying How to Effectively and Efficiently Guide Models with Explanations, Rao et al. (2023)

Considerations (Rao et al., 2023)

Attribution Methods

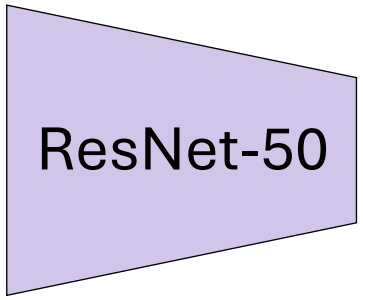


- IxG
- GradCam
- IntGrad
- B-cos

$\mathcal{L}_{\text{loc}}$

- L1
- Energy
- RRR*
- PPCE

Model



- Vanilla
- $\mathcal{X}$-DNN
- B-cos

Evaluation Metrics

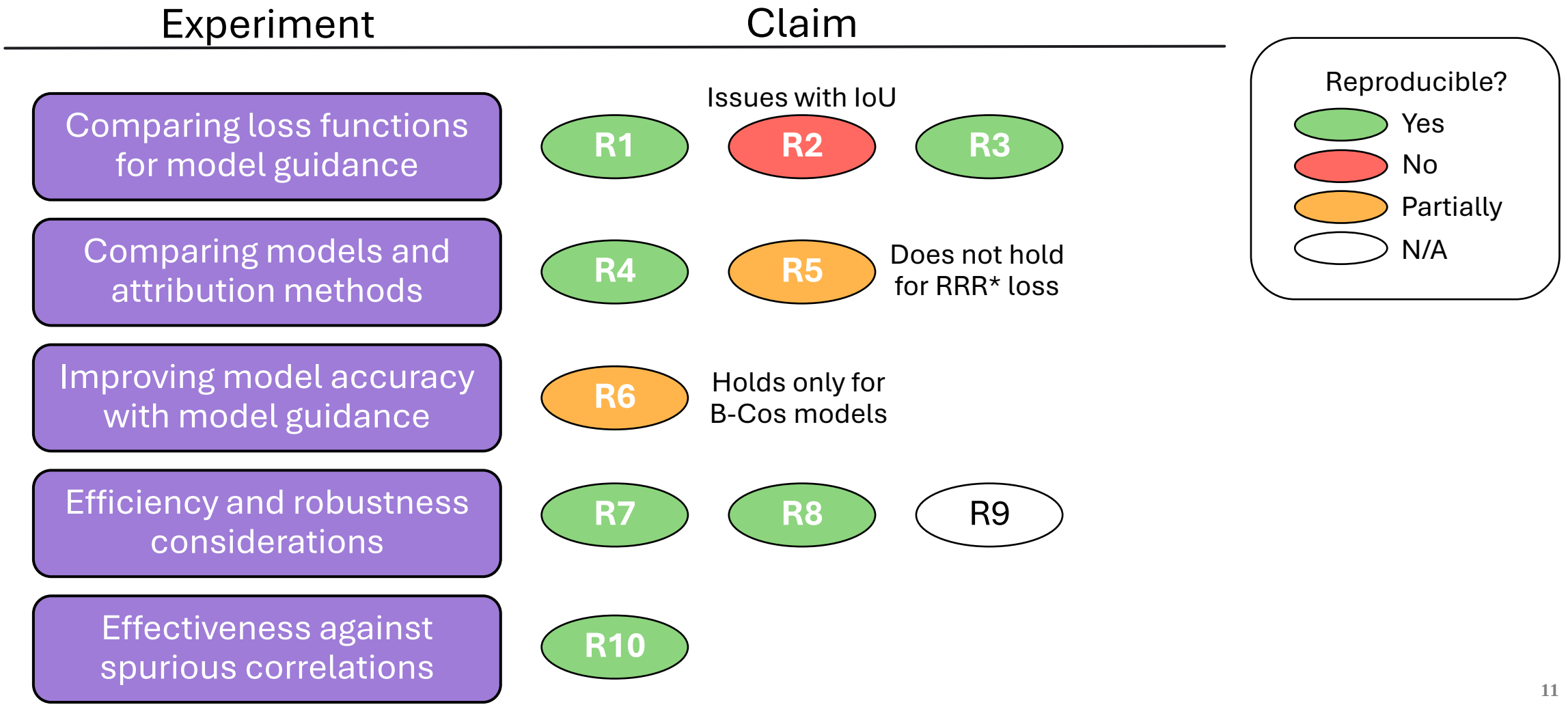
- IoU
- EPG

Objectives

1. **Reproducibility study** (MLRC 2023 Challenge)
   - Verify the main claims of Rao et al. (2023)

2. **Extended work**
   - Address some limitations and propose solutions

Reproducibility Summary



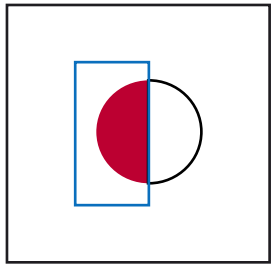
Extensions

1. X-SegEPG
2. EPG vs. Bounding box size
3. The impact of context on image classification
4. Segmentation masks and sparse annotations

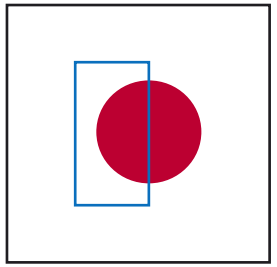
X-SegEPG

Energy-based Pointing Game (EPG)

Positive attributions within the bounding box



All positive attributions



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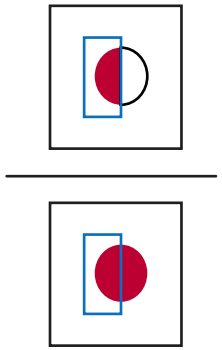
EPG = 

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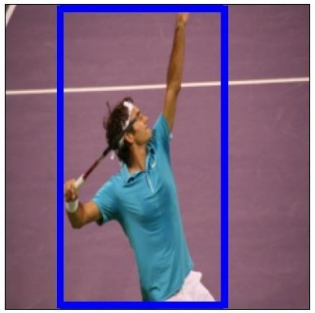
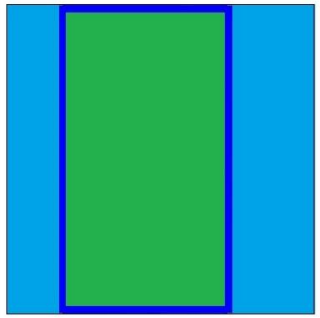
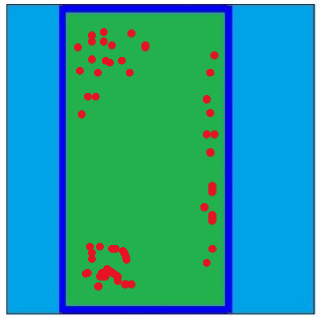


EPG



Correct

Incorrect



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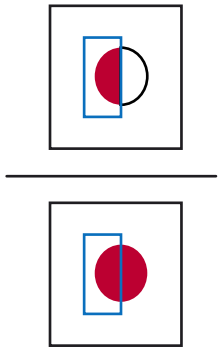
EPG = 

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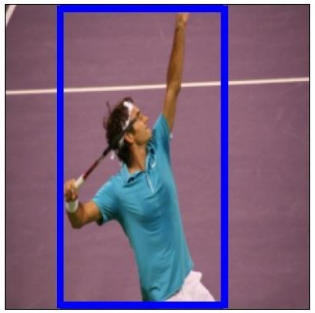

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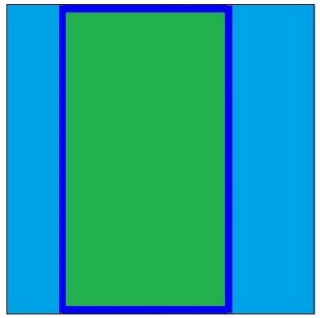

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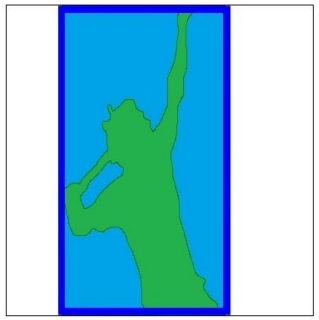

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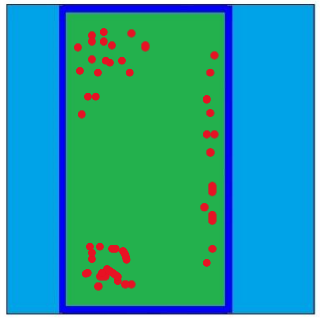

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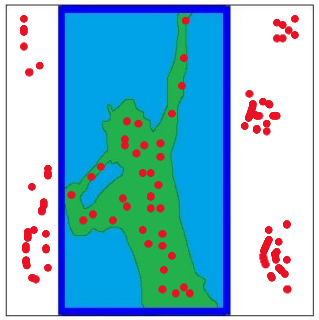

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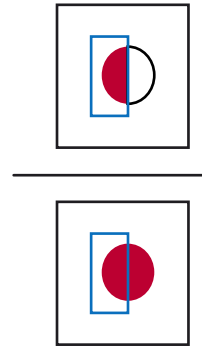
X-SegEPG



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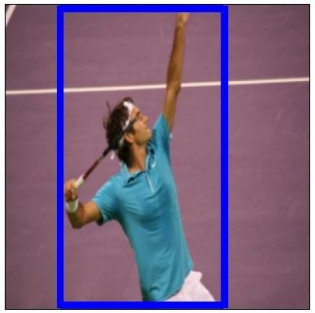

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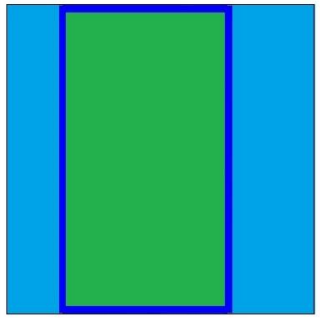

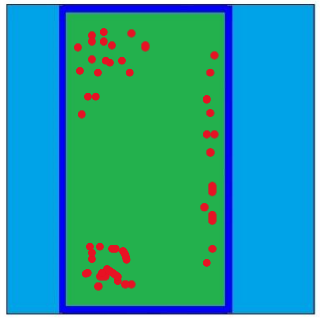

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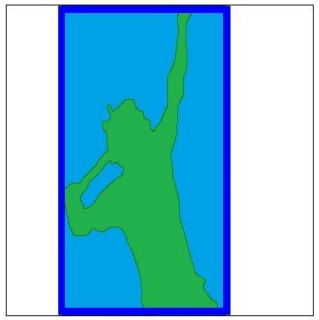
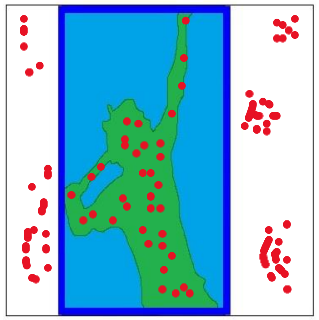
SegEPG





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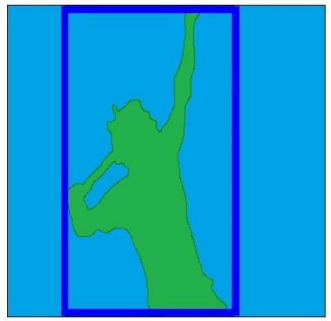
X-SegEPG

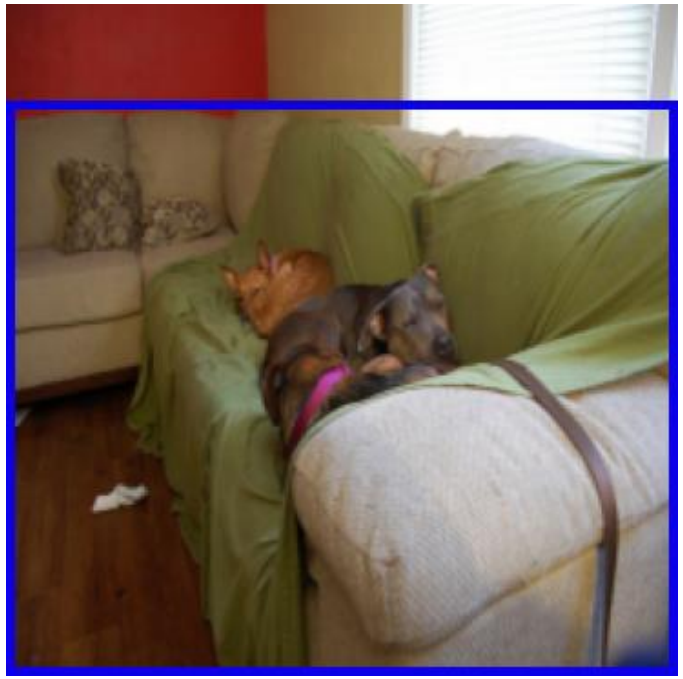


X-SegEPG

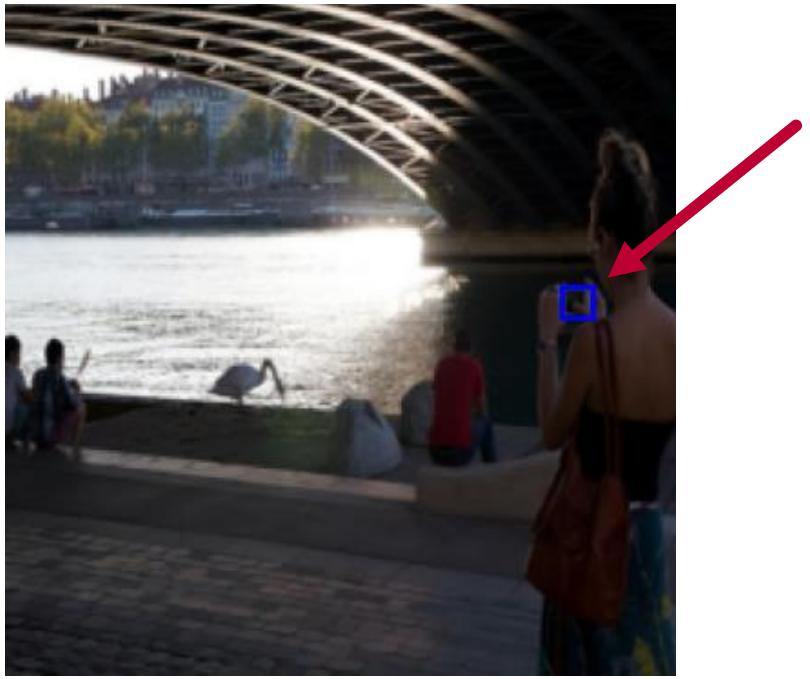
EPG		SegEPG		X-SegEPG	
Val.	Std.	Val.	Std.	Val.	Std.
0.35	±0.23	0.33	±0.25	0.16	±0.2

EPG vs. Bounding Box Size

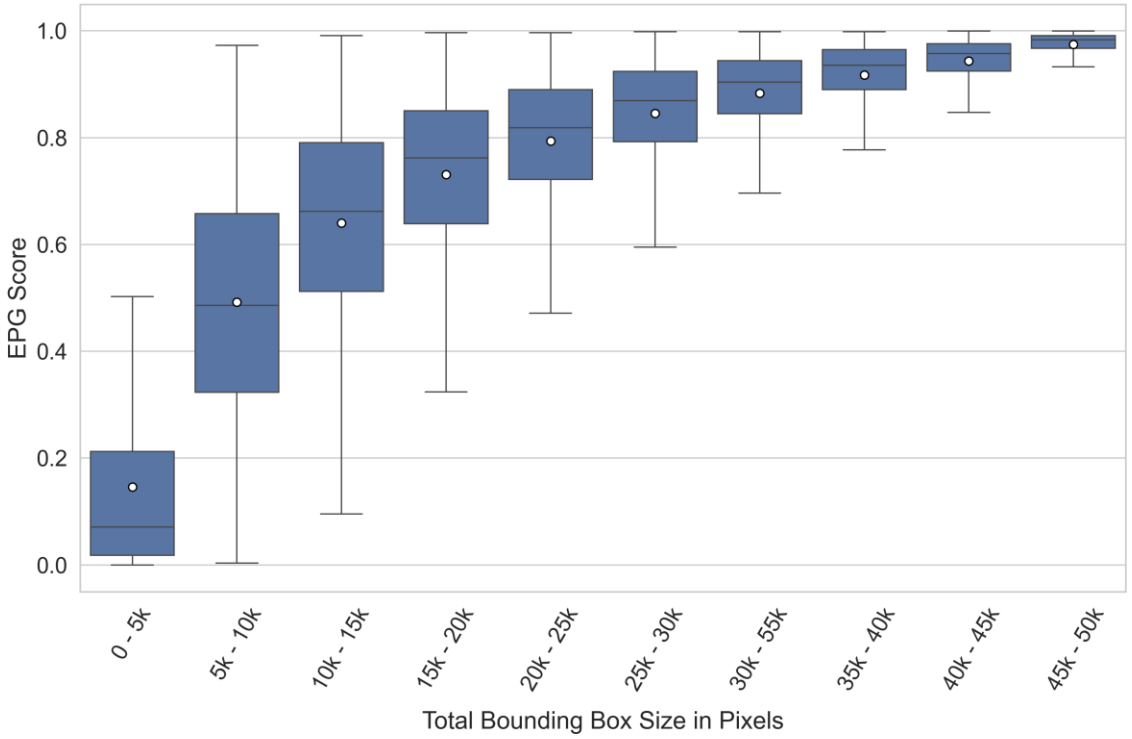
Class: Couch



Class: Phone

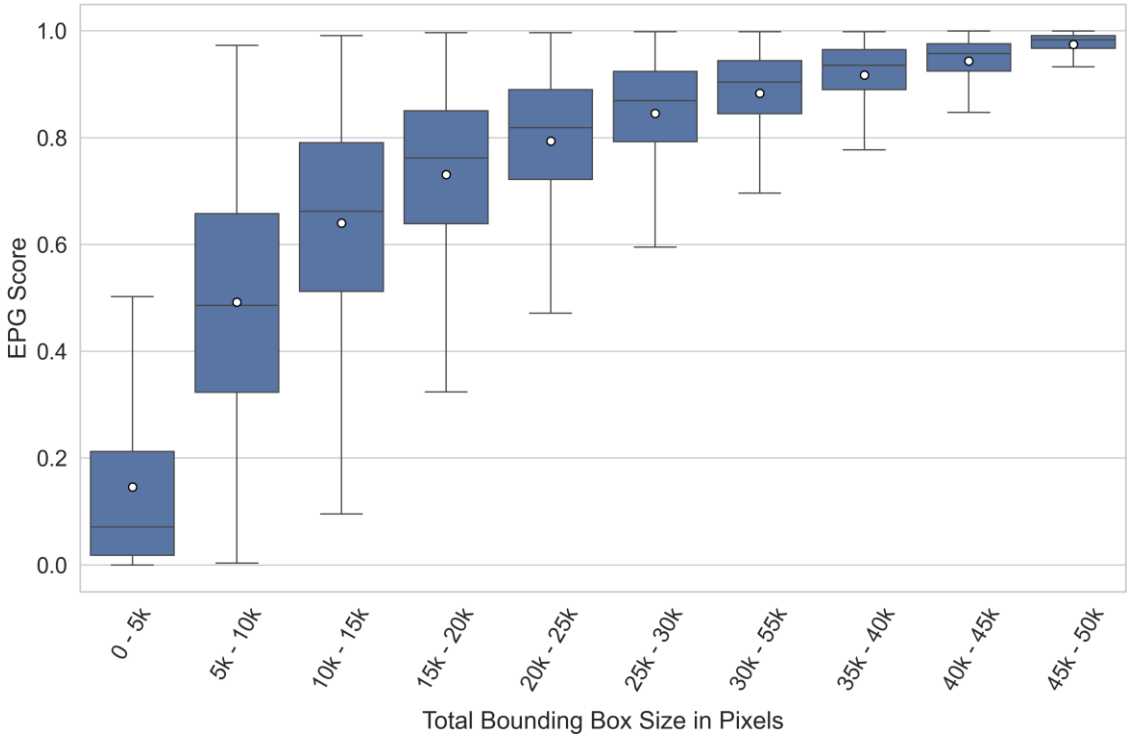


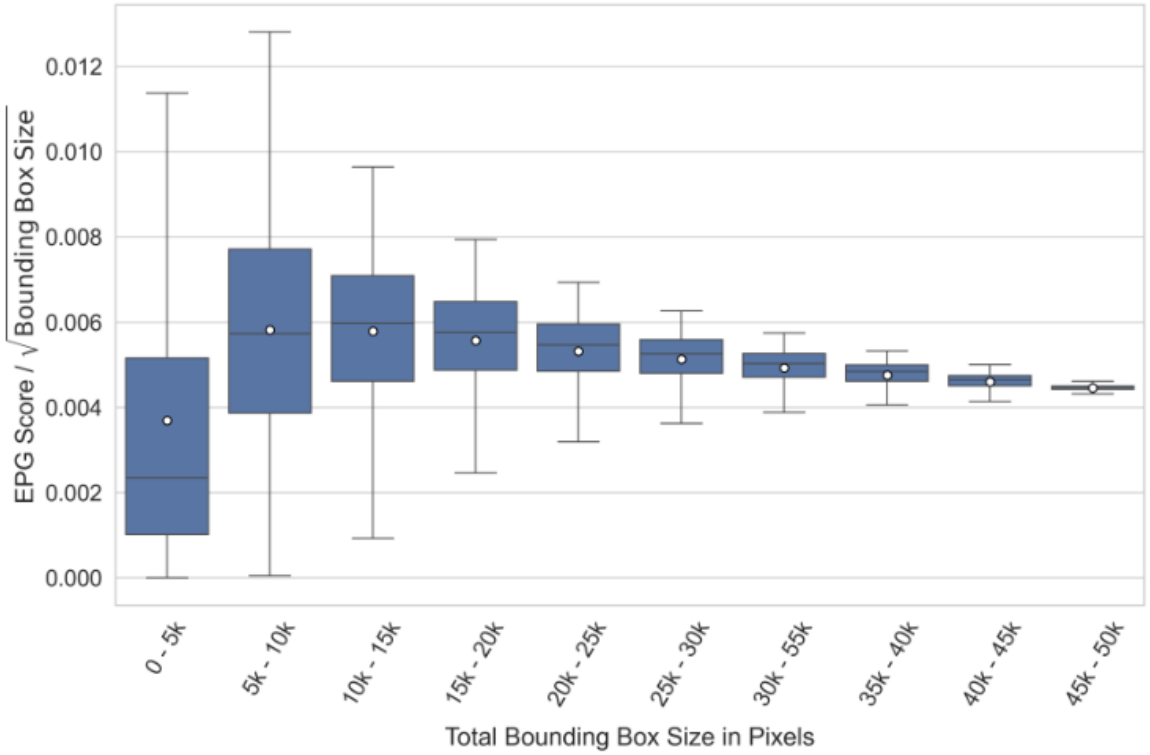
EPG vs. Bounding Box Size



EPG vs. Bounding Box Size

$$\mathcal{L}_{\text{Energy}^*} = 1 - \frac{1}{(\text{BB Area})^{\alpha}} \times \text{EPG}$$





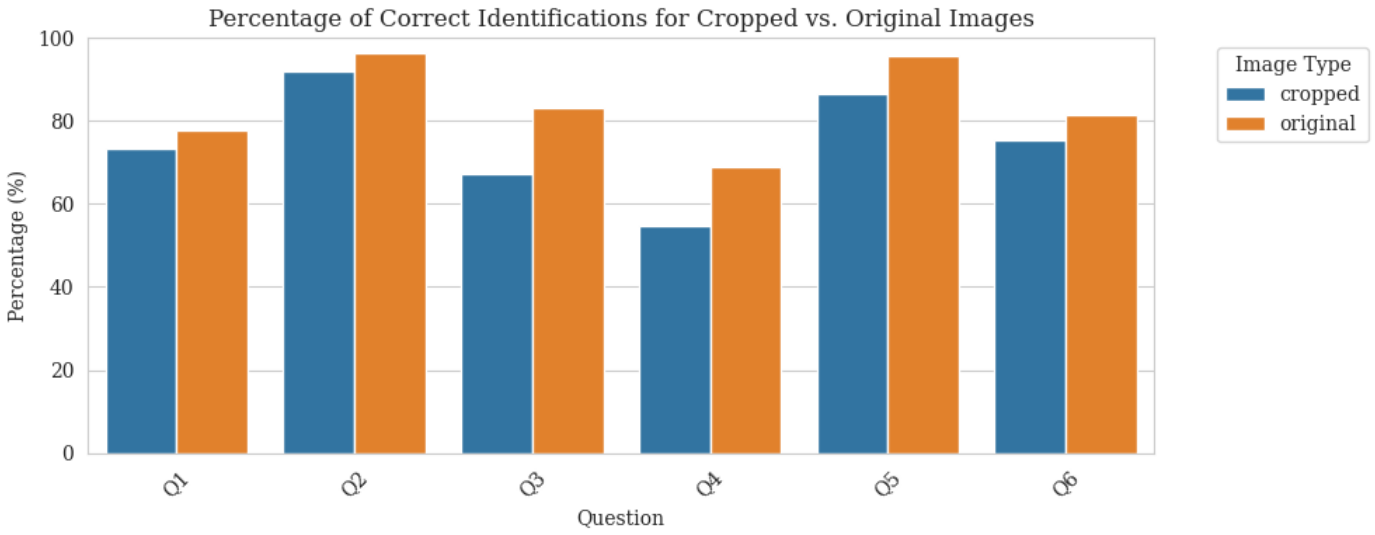
Impact of Context

Is this a **real** or a **toy** car?

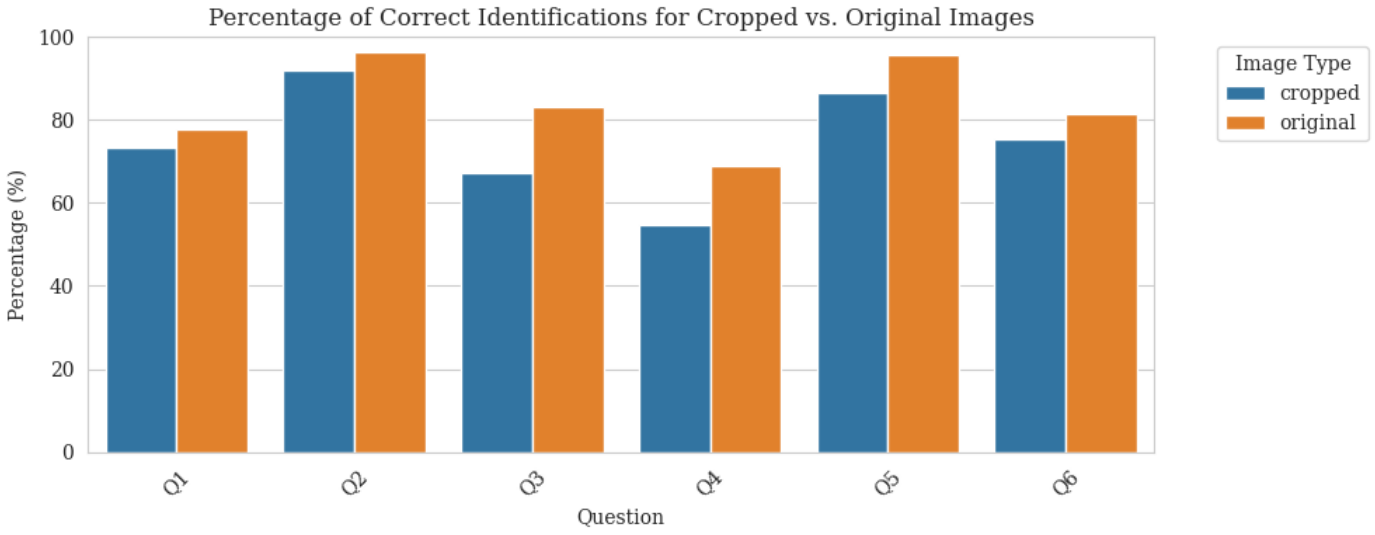
Impact of Context

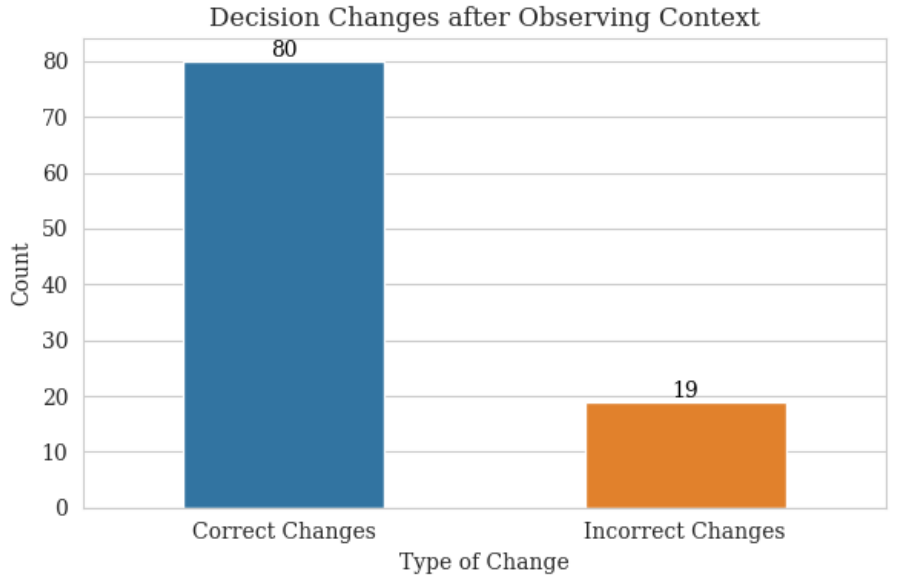
What about now?

Impact of Context



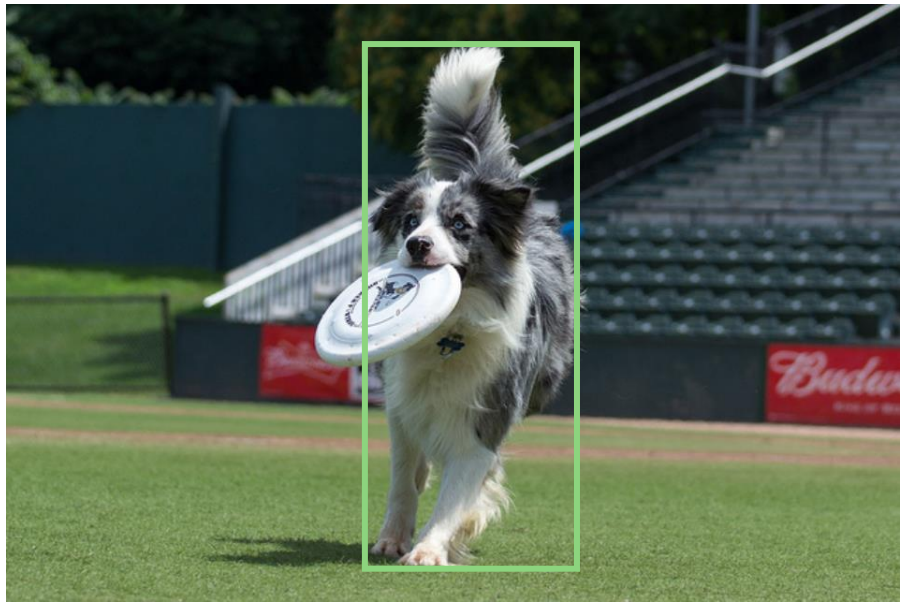
Impact of Context





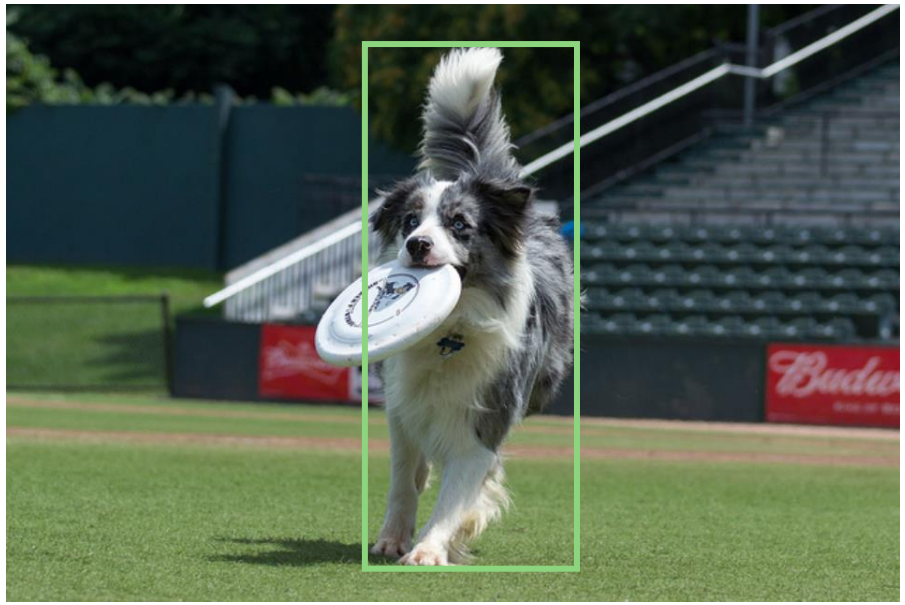
Segmentation Masks and Sparse Annotations

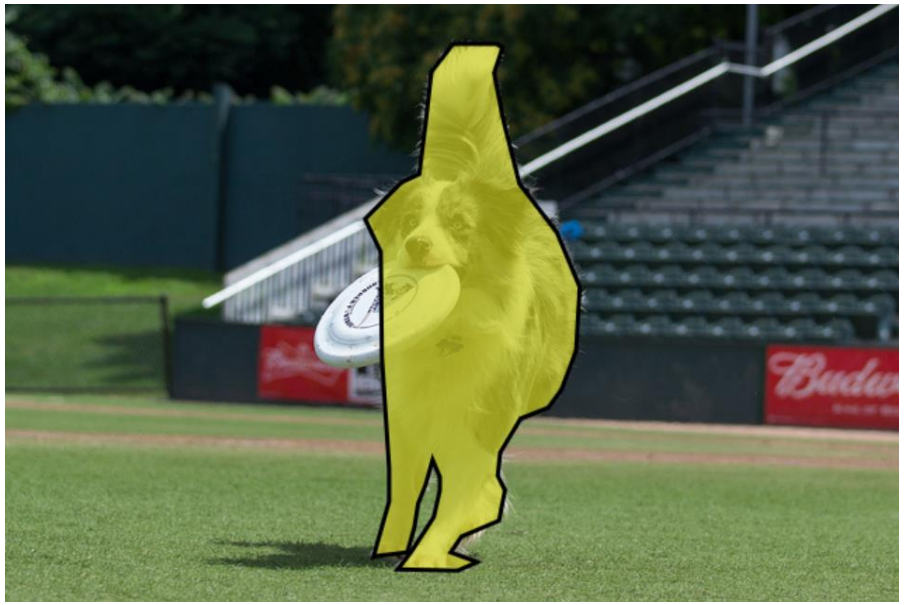
R10: Using as little as **1% of Bounding Boxes** improves model generalization



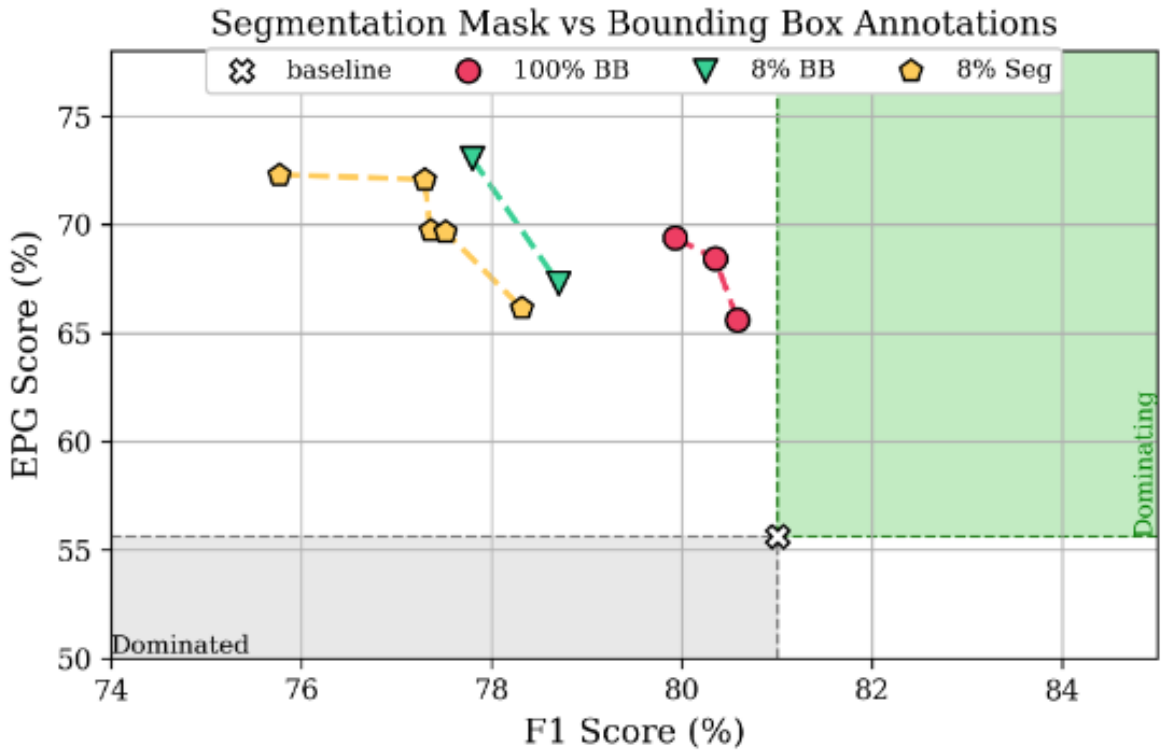
Segmentation Masks and Sparse Annotations

Does that mean that **Segmentation Masks** become affordable?





Segmentation Masks and Sparse Annotations



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Thank you!

[1] Ribeiro, M.T.; Singh, S.; Guestrin, C. “Why should I trust you?” Explaining the predictions of any classifier. In Proceedings of the 22nd ACM SIGKDD International Conference on Knowledge Discovery and Data Mining, San Francisco, CA, USA, 13–17 August 2016; pp. 1135–1144.

[2] Sukrut Rao, Moritz Böhle, Amin Parchami-Araghi, and Bernt Schiele. Studying how to efficiently and effectively guide models with explanations. In Proceedings of the IEEE/CVF International Conference on Computer Vision, pp. 1922–1933, 2023.

Icons: Flaticon.com
Survey images: https://drive.google.com/drive/folders/1cnnEceaKTaG456gvoUi14tzaL4IN_UU-?usp=drive_link