ResNet with one-neuron hidden layers is universal approximator

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Poster #28
In the 90’s: *Universal approximation theorem*

1 hidden layer, width go to infinity $\rightarrow$ **universal approximation**

As the depth go to infinity, how many neurons per layer do we need in order to guarantee the theorem?
Narrow fully connected networks fail!

Narrow: # of neurons per layer \( \leq \) input dimension \( d \)

Classifying the unit ball distribution

Depth increases
Theorem [Lu et al 2017, Hanin and Sellke 2017]: The decision boundary of a narrow FNN is always unbounded.

Narrow fully connected networks fail!

Narrow: # of neurons per layer \( \leq \) input dimension \( d \)

Depth increases
ResNet: residual network

\[
X_{n+1} = X_n + V_n \text{ReLU} \left( W_n X_n + b_n \right)
\]

[He et al 2016a, 2016b, Hardt and Ma 2017]
ResNet with one-neuron hidden layers

Depth increases
Theorem: ResNet with one-neuron hidden layers is a universal approximator when the depth goes to infinity.
Thank you!

Poster #28

05:00 -- 07:00 PM
@ Room 210 & 230 AB