MACHINE LEARNING IN NUCLEAR PHYSICS*

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*BASED ON THE ANECDOTAL EVIDENCE OF MICHELLE KUCHERA

Rapidly emerging application area

Experiment AND theory are evolving

Requires education/retraining for more widespread adoption

A lot of “word-of-mouth” development methods

High energy physics — hit this wall in the 90's

2009: single top quark production: Boosted decision trees, Bayesian Neural Networks, etc.

https://arxiv.org/pdf/0903.0850.pdf

Keep an eye on literature from high energy and other physics fields

Keep a pulse on machine learning research

MACHINE LEARNING RESEARCH

Where to find recent results:

Conference proceedings, arXiv and blog posts!

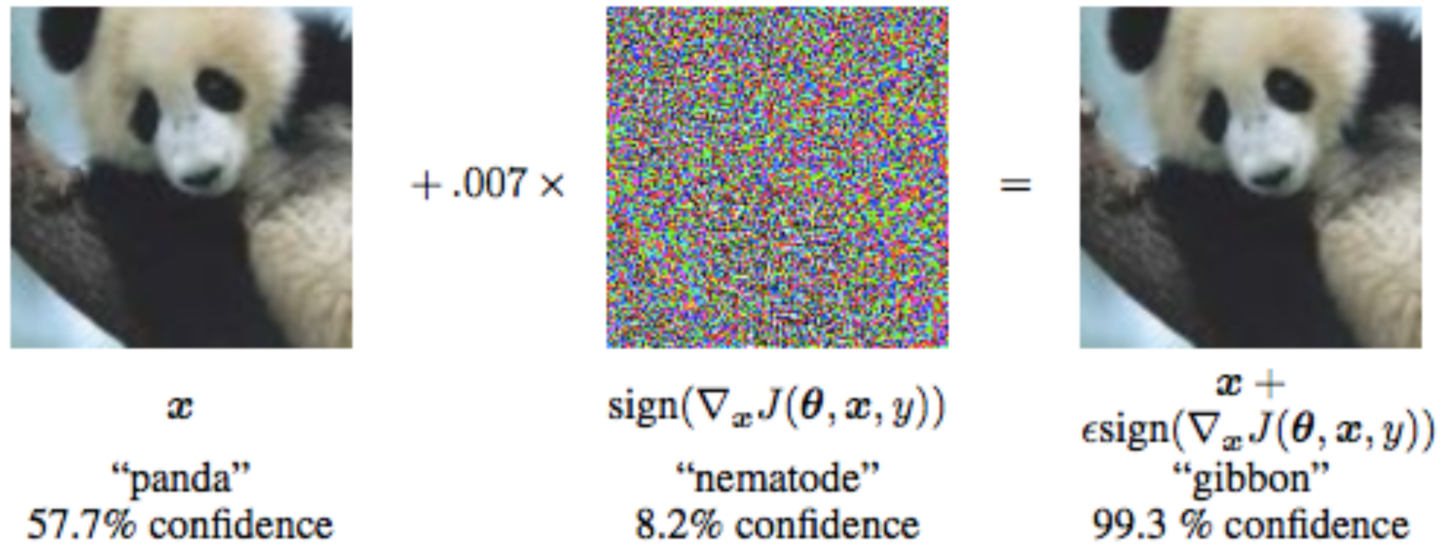
NIPS: Neural Information Processing Systems https://papers.nips.cc

ICLR: International Conference on Learning Representations https://openreview.net/group?id=ICLR.cc/2018/Conference#accepted-oral-papers

ICML: International Conference on Machine Learning

(Journal of Machine Learning Research http://www.jmlr.org/papers/v18/)

Hot topics right now:



From Explaining and Harnessing Adversarial Examples by Goodfellow et al.

adversarial examples: https://medium.com/@neural-networks-create-your-own-adversarial-examples-a61eb7620fd8

zero shot learning: https://arxiv.org/pdf/1707.00600

transfer learning

model interpretability: https://christophm.github.io/interpretable-ml-book/interpretability.html

STARTING A NEW MACHINE LEARNING PROJECT

Cheatsheet:

1. Identify problem type: classification, generation, regression

2. Consider your data carefully

3. Choose a simple model that fits 1. and 2.

4. Consider your data carefully again… data representation

5. Based on results, feedback loop to earliest possible point

3. Choose a model:

Supervised?

Start with the simplest model that fits your problem

Start with minimal processing of data