Machine Learning for Economists: Neural Networks and Deep Learning

Gentle Introduction

International Monetary Fund

Washington, D.C.,
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Disclaimer #1:

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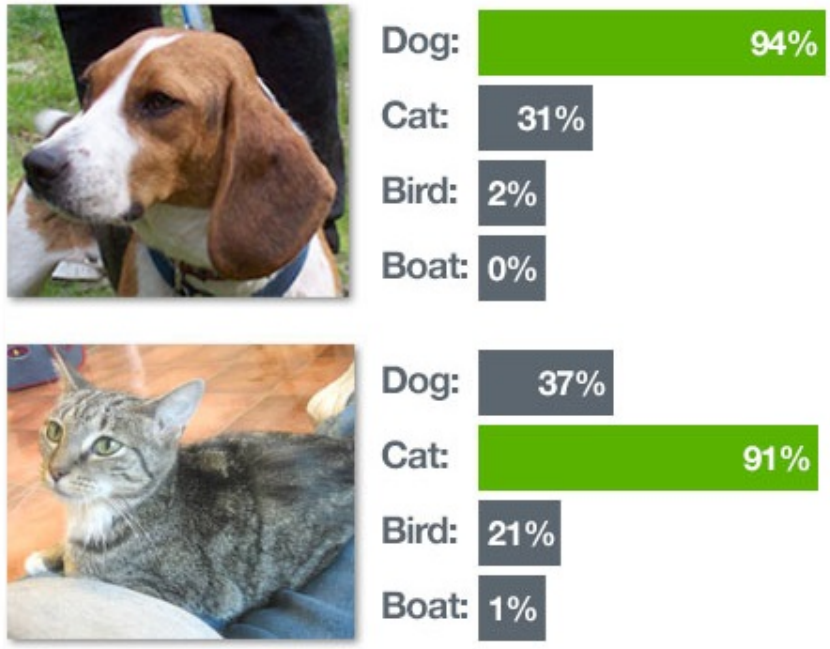
Neural Networks

Neural networks are behind the most impressive and medialized successes of machine learning in recent years...

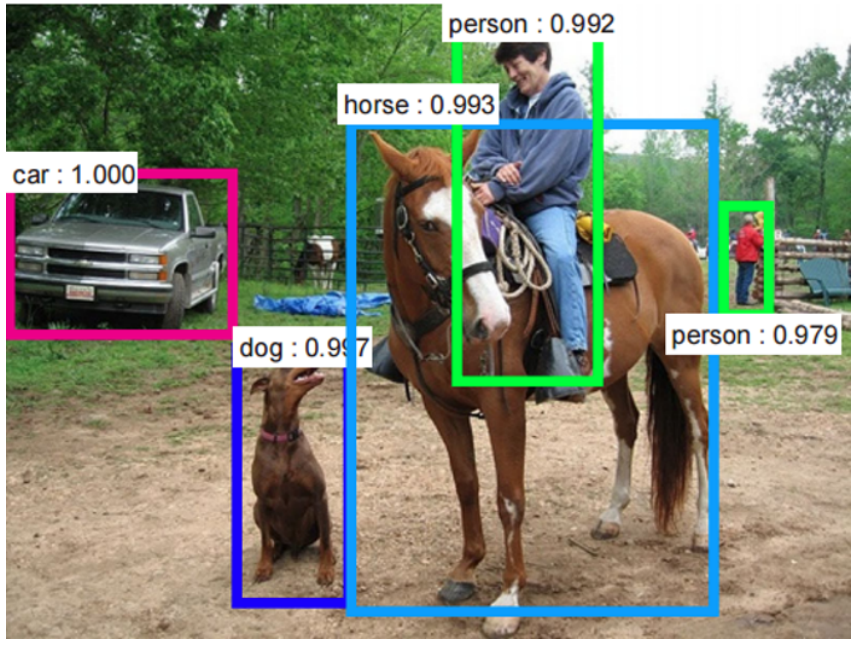
Examples:

- language translation (e.g. Google translate) progress
- image/object recognition (self-driving cars, radiology, tumor scans, etc.)
- speech recognition and translation
- reinforcement learning advances (playing Go, ...)
- ...

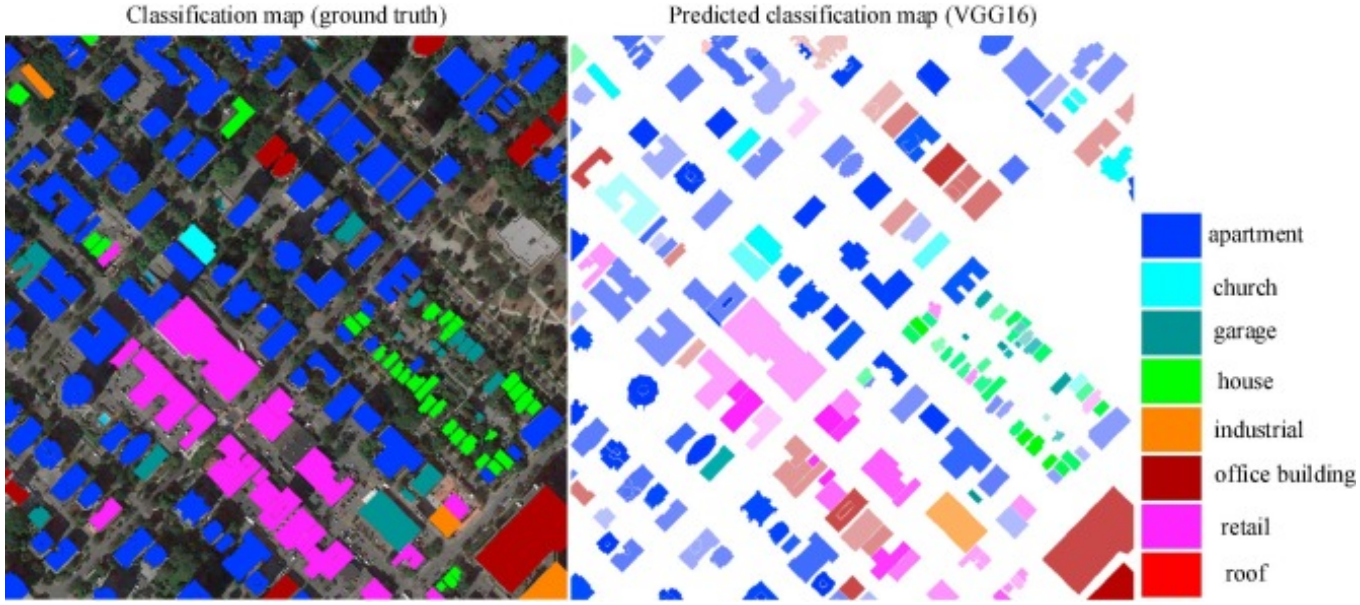
Neural Networks



Neural Networks



Neural Networks



Style Transfer

Style Transfer

Neural Networks

x

"panda"
57.7% confidence

$+ .007 \times$

$\text{sign}(\nabla_{\boldsymbol{x}} J(\boldsymbol{\theta}, x, y))$

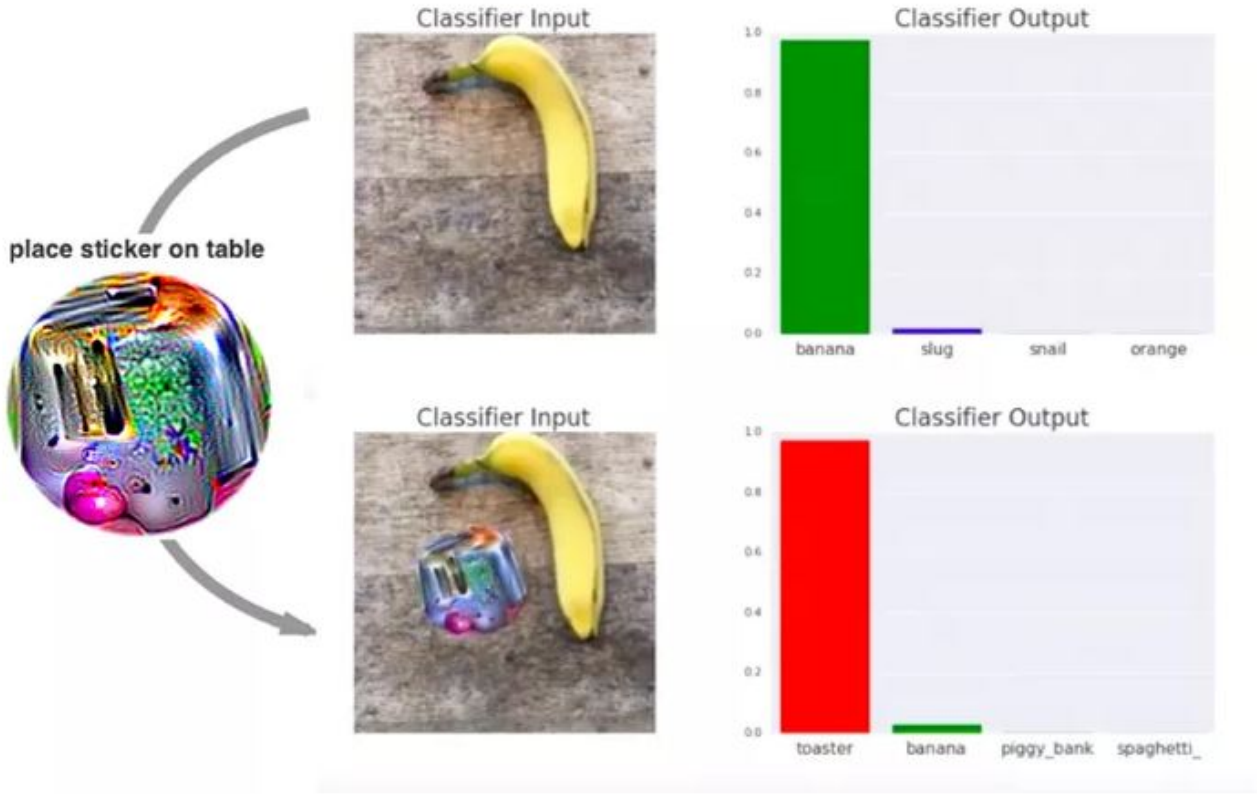
"nematode"
8.2% confidence

$=$

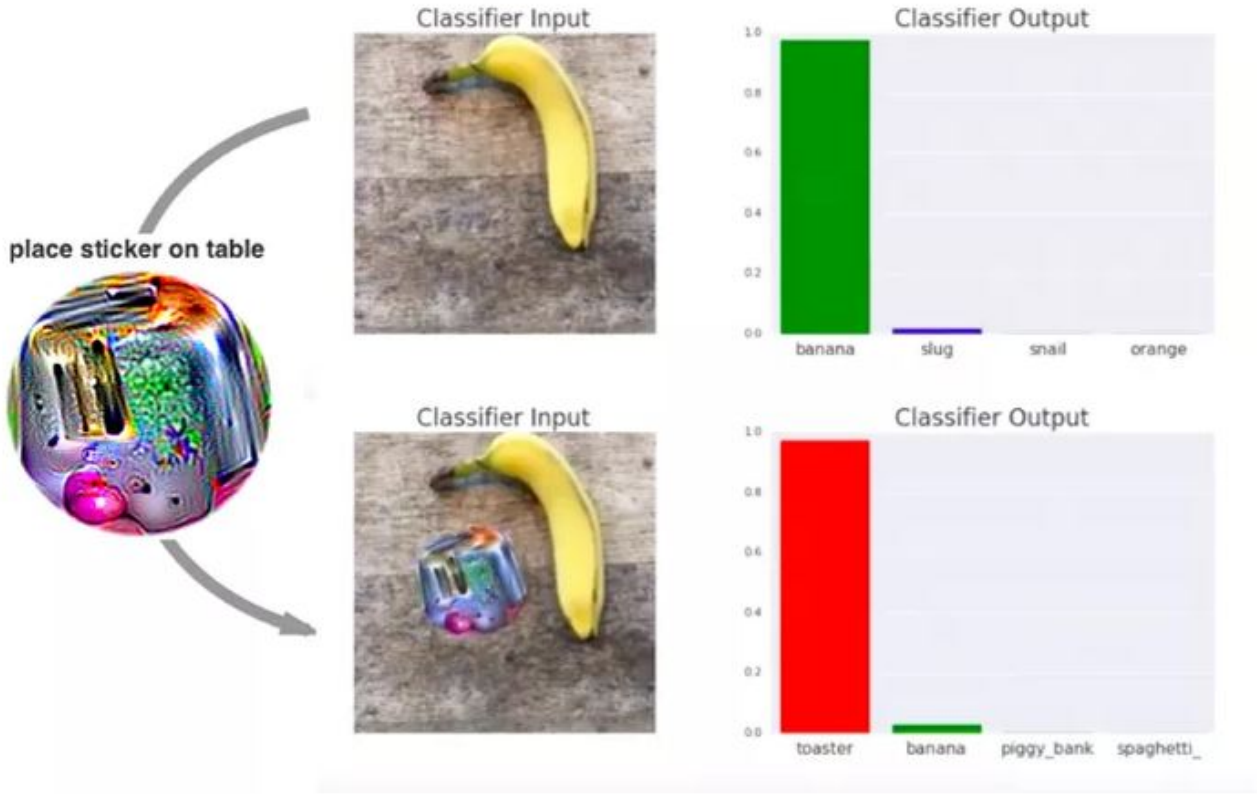
$x + \epsilon\text{sign}(\nabla_{\boldsymbol{x}} J(\boldsymbol{\theta}, x, y))$

"gibbon"
99.3 % confidence

Neural Networks



Deep Fakes


place sticker on table
Classifier Input
Classifier Output
banana
slug
snail
orange
Classifier Input
Classifier Output
toaster
banana
piggy_bank
spaghetti_

Neural Networks