Neural Nets in Application

CS 1501 Section 001

Instructor: Andrew Draganov

Today’s Content

- Syllabus
- Course Introduction
  - What is Machine Learning/Deep Learning?
  - Why is it important?

Course Schedule

- 2 lectures intro to machine learning
- 2 lectures intro to vanilla neural network
  - And the math that makes them work
- 3 lectures to discuss types of neural nets
  - Auto-encoders, Convolutional nets, Recurrent nets
  - Maybe 4th lecture with GANs
- 4 lectures to discuss the most relevant papers
  - 1 per lecture
- We have 14 weeks, so we'll buffer material that doesn't get done in a single lecture

Syllabus

- Grading
  - 33.3 % for attendance, participation and essay each
    - Attendance is a 0 if you attend fewer than 10 classes
    - Participation starts at 100%, lose 50% every time your card gets pulled and you aren’t here
  - Need a 70% to pass
- Faculty Sponsor
  - Mark Floryan, mfloryan@cs.virginia.edu
  - Contact him if you have any concerns with how the course is being presented

Syllabus

- Prereqs
  - Calc 3, CS 2150
  - (preferably) CS 4102 and Linear Algebra as well
- Homework
  - Required readings (never more than 10 pages a week)
  - One two page paper summary at the end of the semester
    - Due the day that paper is being discussed
- No laptops/phones

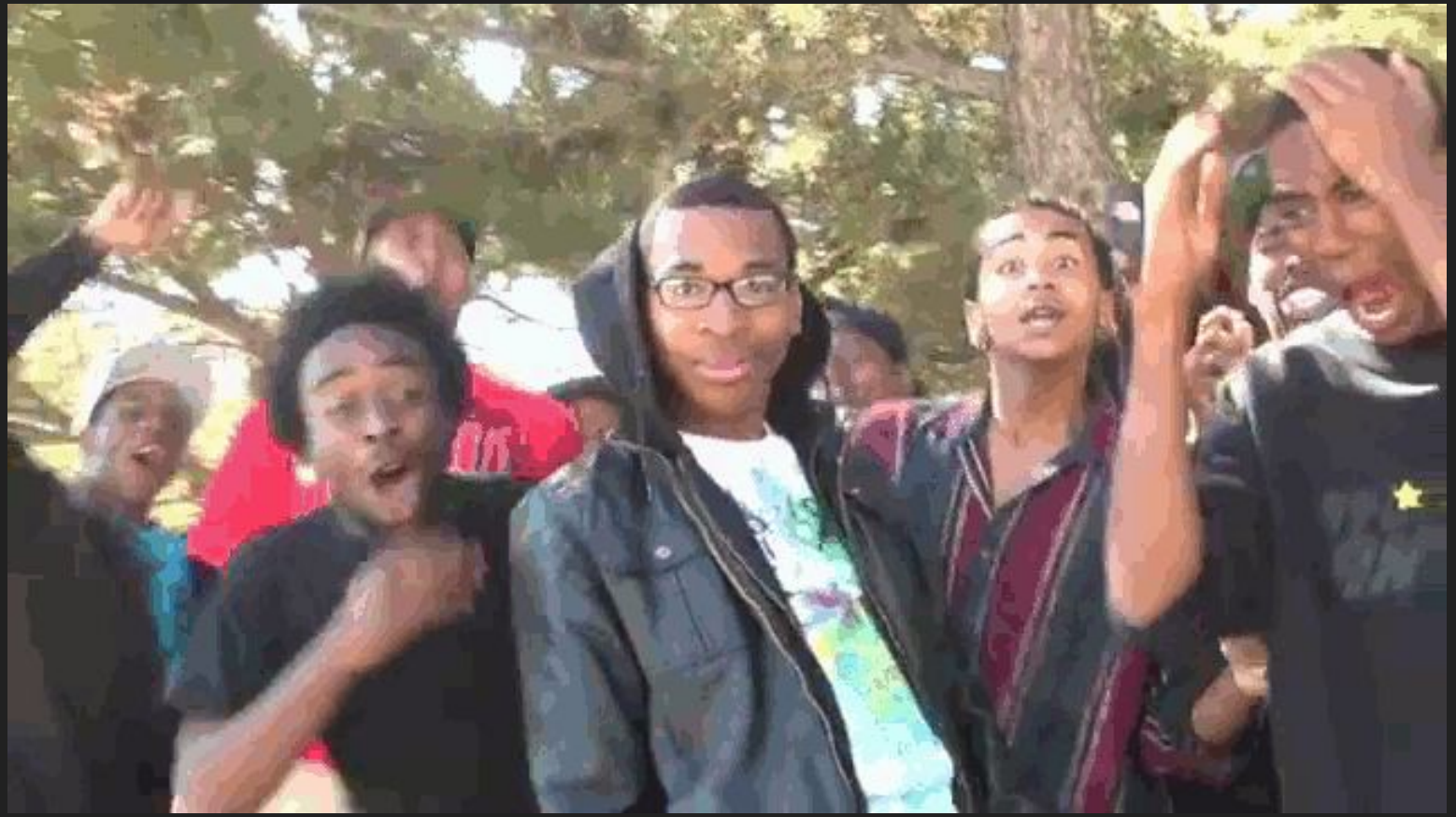
My expectations from you

- Come to class having read the reading
- Ask questions!!!

So why are you taking this class?

Machine Learning = Fire

Deep Learning = Supa Hot Fire



Let’s start from the basics

- Machine learning is a method of data analysis that automates analytical model building
- In essence, a machine learning system learns a model through exposure to data
- That’s how you learned too

ML Systems are inherently learning from scratch

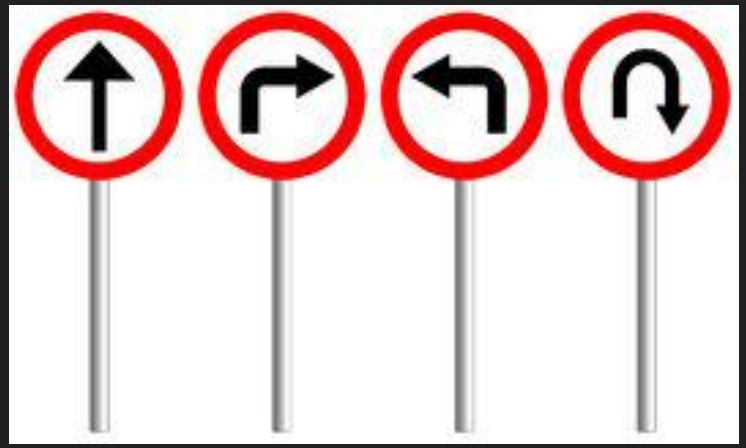
- All of our rules are arbitrary to them
- They have no context other than what they learn from the data

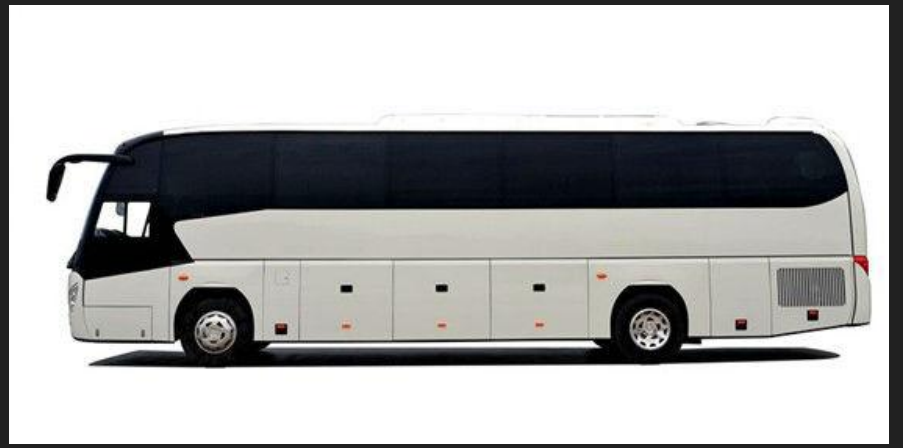
Let’s do an activity where we are the ML system

- We’re learning **borks** from **not-borks**

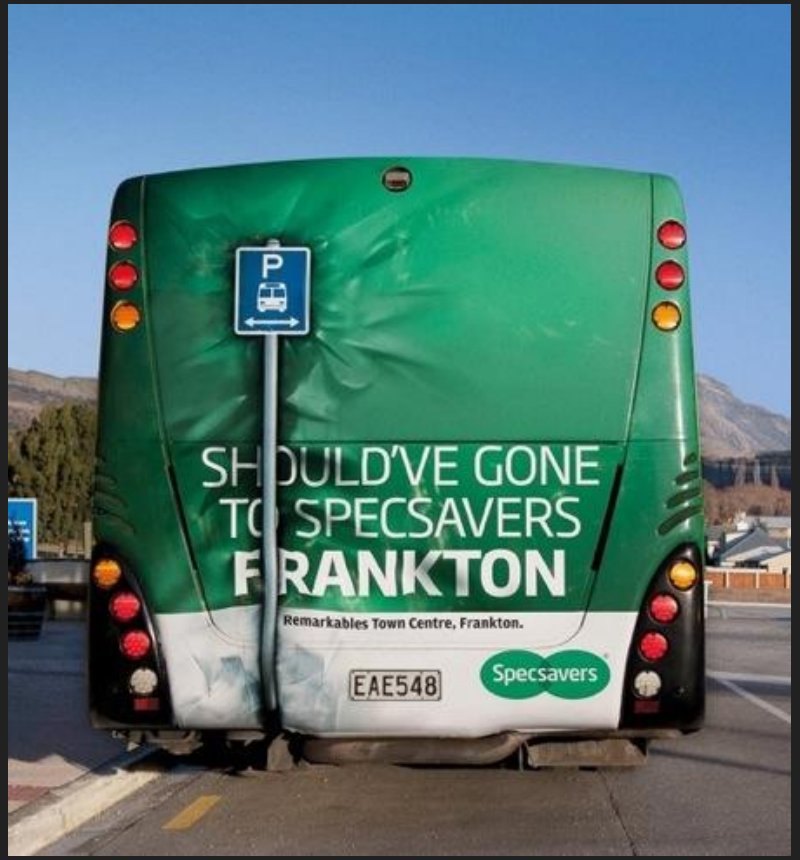
But learning in the real world is really hard

- For example, self driving cars needs to not hit anything
  - This means they must differentiate between **every** obstacle
  - We'll talk about just buses and traffic signs right now
  - Let's list a few characteristics of each





Okay, so how about this?



So how good have our systems gotten?

http://aotw-pd.s3.amazonaws.com/images/mpix110721_0792_retouched.jpg

https://www.captionbot.ai/

So how do ML systems learn to this level of detail?

- DATA!!!
  - But what is good data?

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- DATA!!!
  - But what is good data?

Good data covers our entire problem space

We'll talk more about data next lecture

Different machine learning algorithms

- Decision Trees
- Nearest Neighbors
- Linear Regression
- Logistic Regression
- Naive bayes
- SVMs
- K-Means
- Neural Networks

Classes of machine learning problems

- Classification
- Regression
- Clustering
- Generation

We’ll mostly focus on classification, with small tidbits about the others

Specific ML problems we'll discuss in class

- Solving for general functions
- Data compression/Dimensionality reduction
- Image classification
- Natural Language Processing

That’s it for today