11-695: Competitive Engineering
Deep Learning Algorithms with TensorFlow

Spring 2018

Logistics

Carnegie Mellon

- Course staffs:

Instructors

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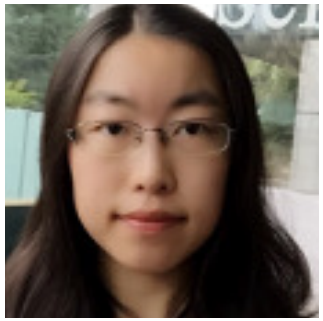

Yijia Jin

- Class website:
  - Lectures slides; notes; announcements
  - Coming soon
- Piazza: `https://piazza.com/class/jcc5x8zf60sz1`

Why should I take this class?

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Because you want to learn Deep Learning.

Image Classification

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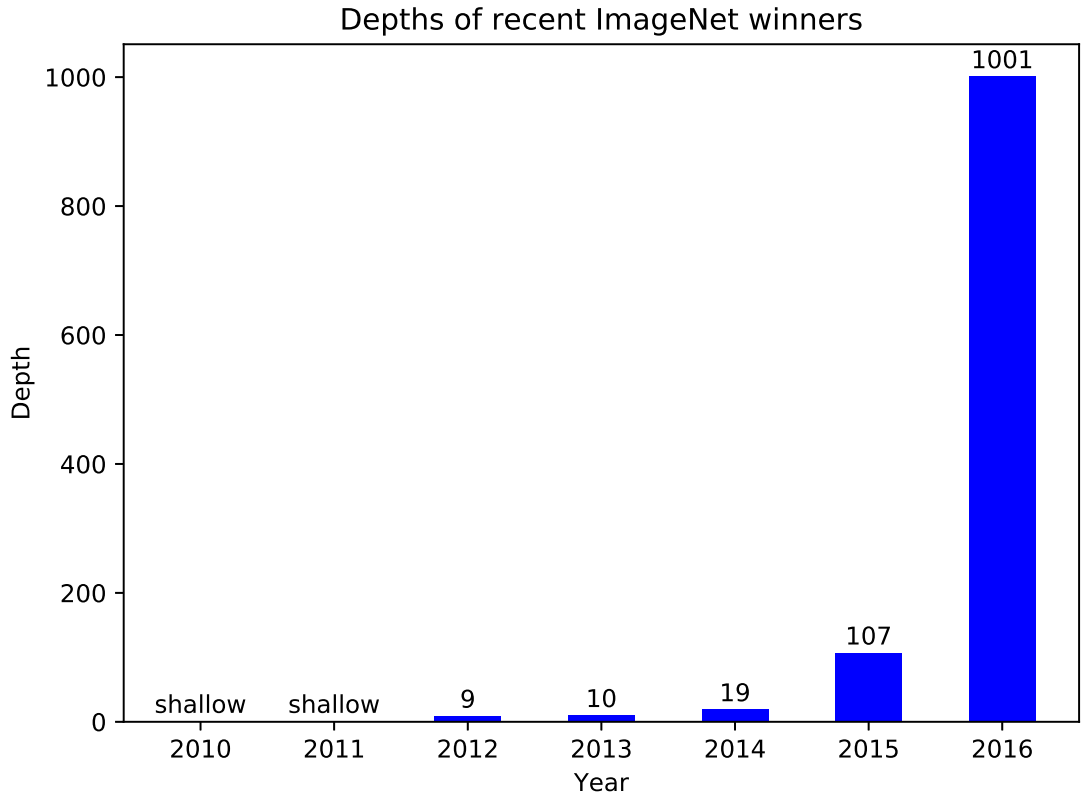
ImageNet classifcation task:

- The Holy Grail of computer vision
- 1,000,000 large images; 1,000 labels



Machine Translation

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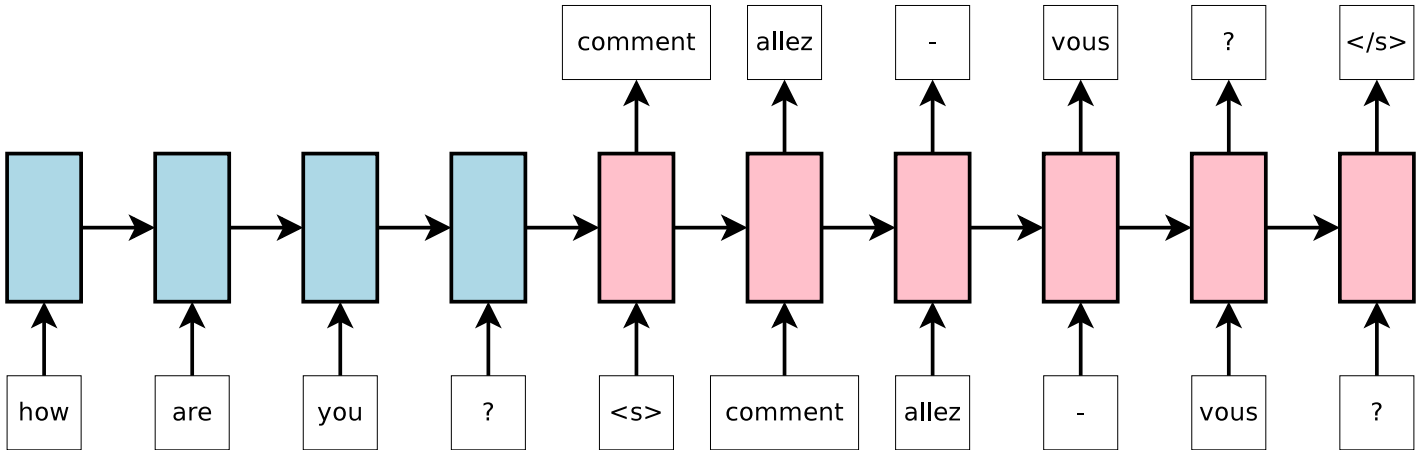
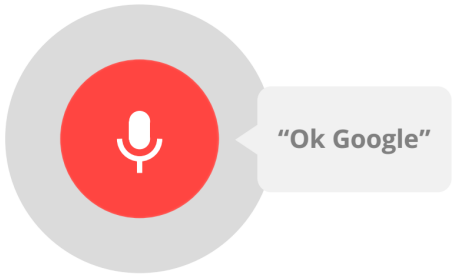
Virtually all popular automatic translation software

- Google, Facebook, Bing, Baidu



Speech Recognition

If you use one of these



Then you're using deep learning

Replicate Van Gogh

(a) Content and Style (b) (0.9, 0.1) (c) (0.7, 0.3) (d) (0.5, 0.5) (e) (0.3, 0.7) (f) (0.1, 0.9)

Li, Wang, Liu, Hou. *Demystifying Neural Style Transfer*. IJCAI 2017.

Defeat the World Champion in Go

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Source: https://www.cnet.com/

Healthcare

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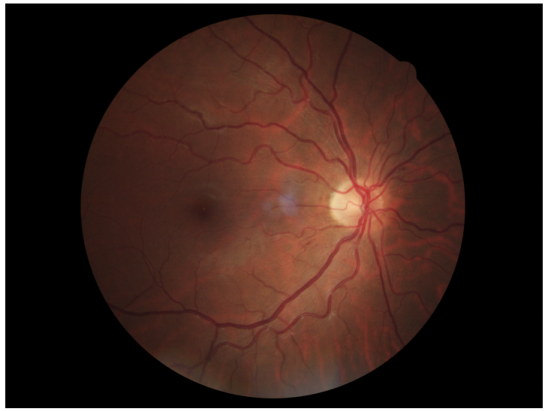
ImageNet classifcation task:

(a) Healthy



(b) Mild NPDR

(c) Moderate NPDR

(d) Severe NPDR

Guan, Gulshan, Dai, Hinton. *Who Said What: Modeling Individual Labelers Improves Classification.* AAAI 2018.

How about other Deep Learning Classes?

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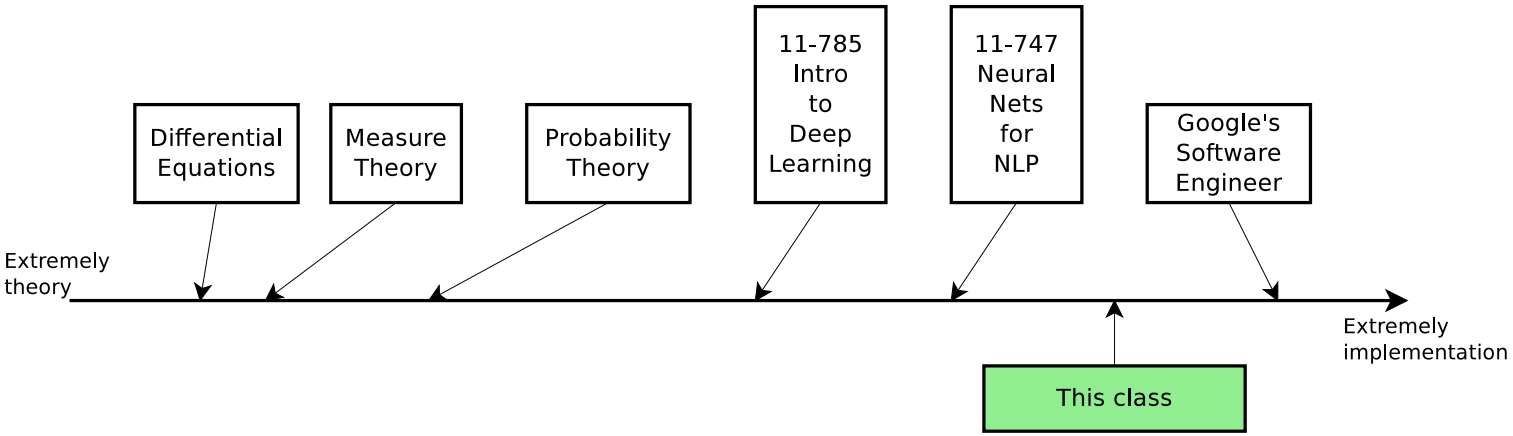
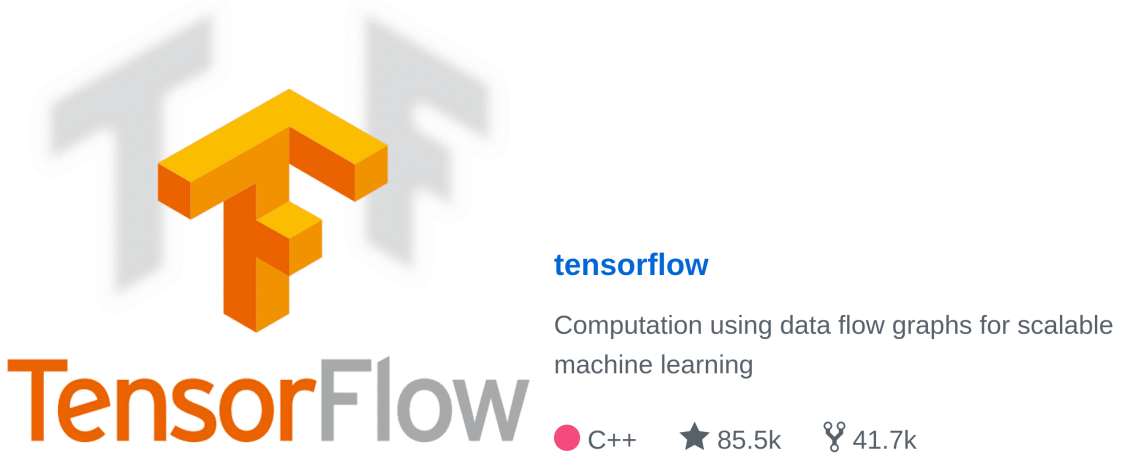


- Focus on **implementation** and **software engineering**
  - You will learn `TensorFlow` and its subtleties
- Boost your understanding of **deep learning algorithms**
  - Nothing redundant.

Why TensorFlow?



- A good deep learning platform
  - Strong GPU support, seamless distributed computing, etc.
  - Active online community, from academia to industry
- Teaches important insights
  - Modular designs, computational graphs, static vs dynamics, etc.

Roadmap

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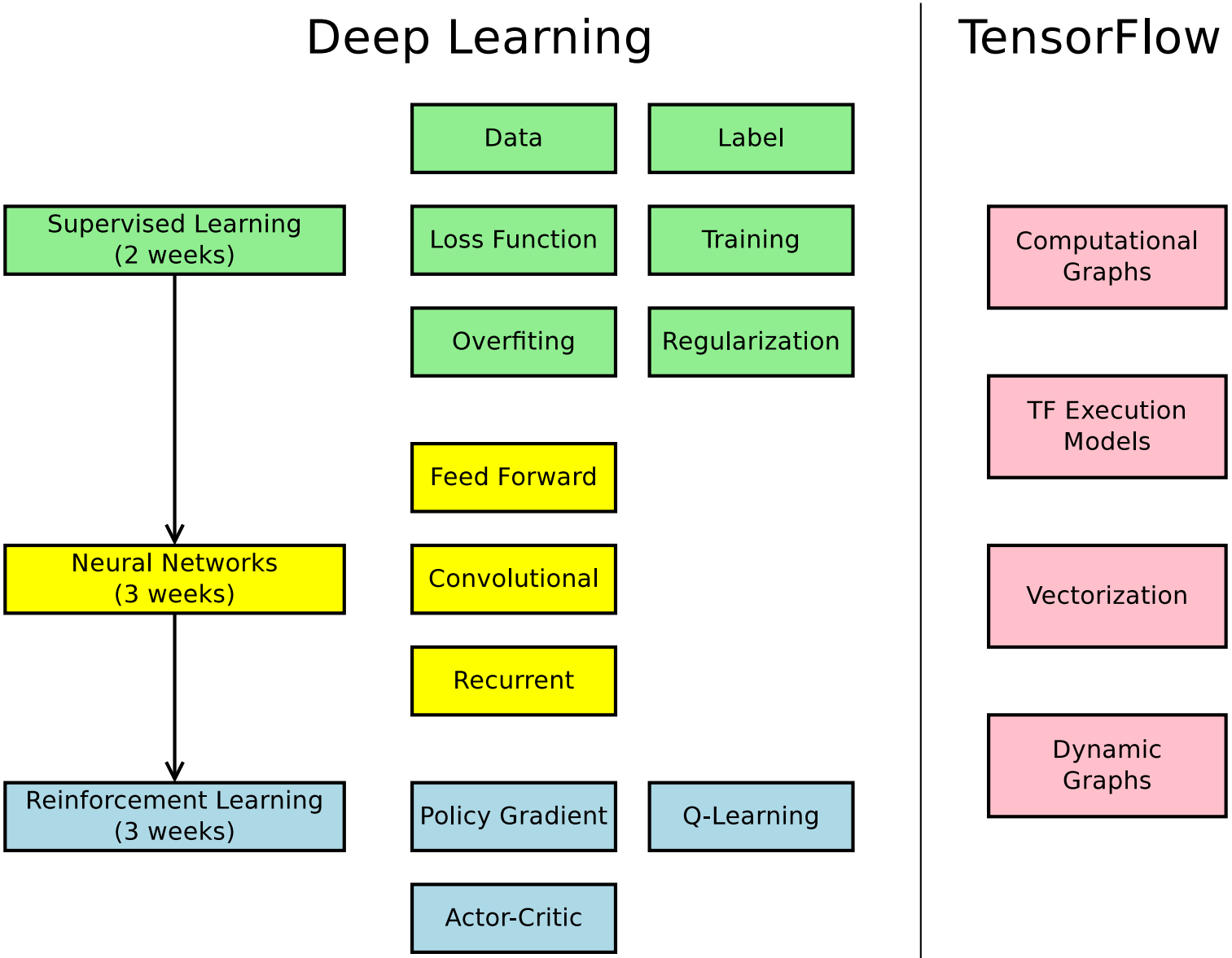
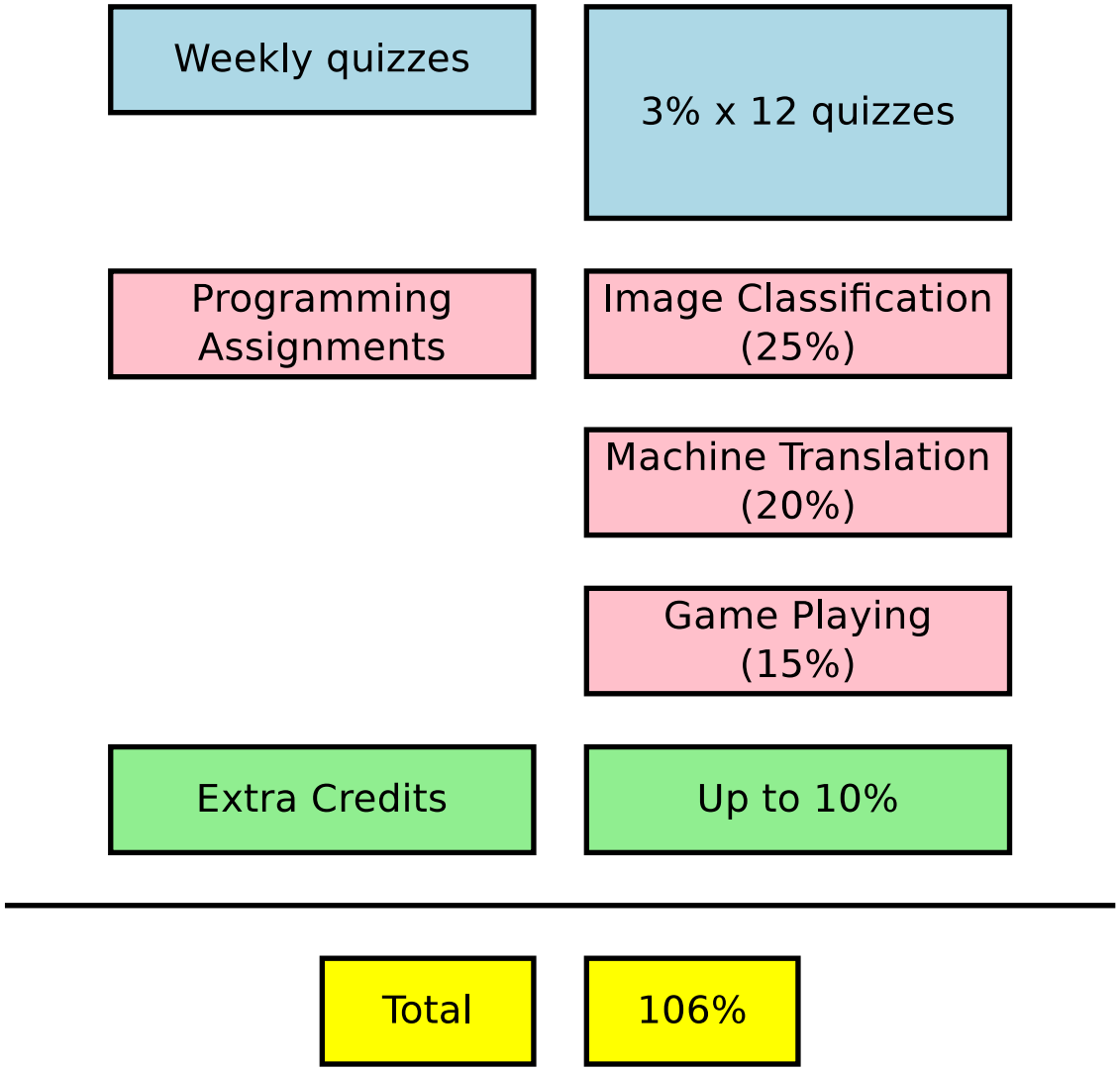


Gradings


Weekly quizzes
3% x 12 quizzes
Programming Assignments
Image Classification (25%)
Machine Translation (20%)
Game Playing (15%)
Extra Credits
Up to 10%
Total
106%

Weekly Quizzes

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- Tests the knowledge *from the last week*
  - Multiple choice; Fill in the blank; Short answers, etc.
  - 10-15 minutes, at the end of Thursday lectures
- Sample quizz:

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1. Does regularization increase or decrease bias? How about variance?
2. In a feedforward neural network, layer 5 has 128 units, and layer 6 has 256 units. What is the size of $\mathbf{W}^{5,6}$?
3. Find $f'(x)$ where $f(x) = x \cdot \text{sigmoid}(\beta x)$.

Programming Assignments

- Python: `NumPy` and `TensorFlow`
- Download starter code and submit assignment via `git`
  - Please create your account on `https://bitbucket.org/`
  - then email us or request access to the assignment repo.
  - More on this next time.
- Assignments are **hard,** but:
  - You will have enough time if you **start early**
  - You won't need GPUs `:-)`

Policy on Cheating

- We will *mostly stay outside of the classroom* during your quizzes
  - so please keep yourselves honored.
  - If you get caught, you're escalated to higher levels.
- Plagiarism check is run *for each assignment*
  - First time caught: all involved parties get 0.
  - Second time: all involved parties get worse than 0.