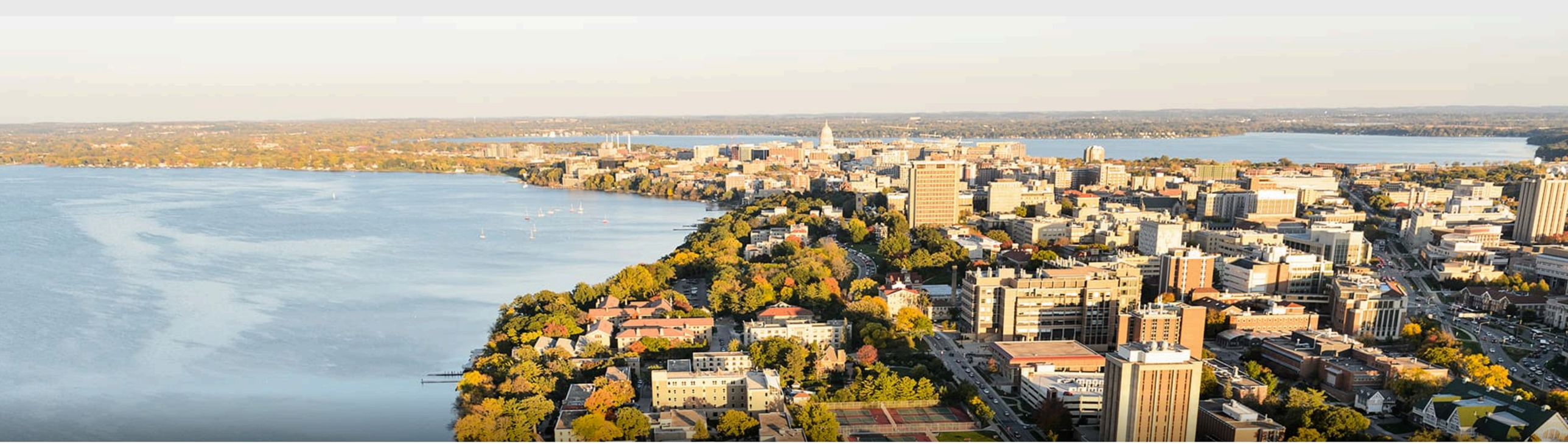


CS 540 Introduction to Artificial Intelligence
Course Overview

Yudong Chen
University of Wisconsin-Madison

[09/14/2021]

Modified from slides by Sharon Li

Today's outline

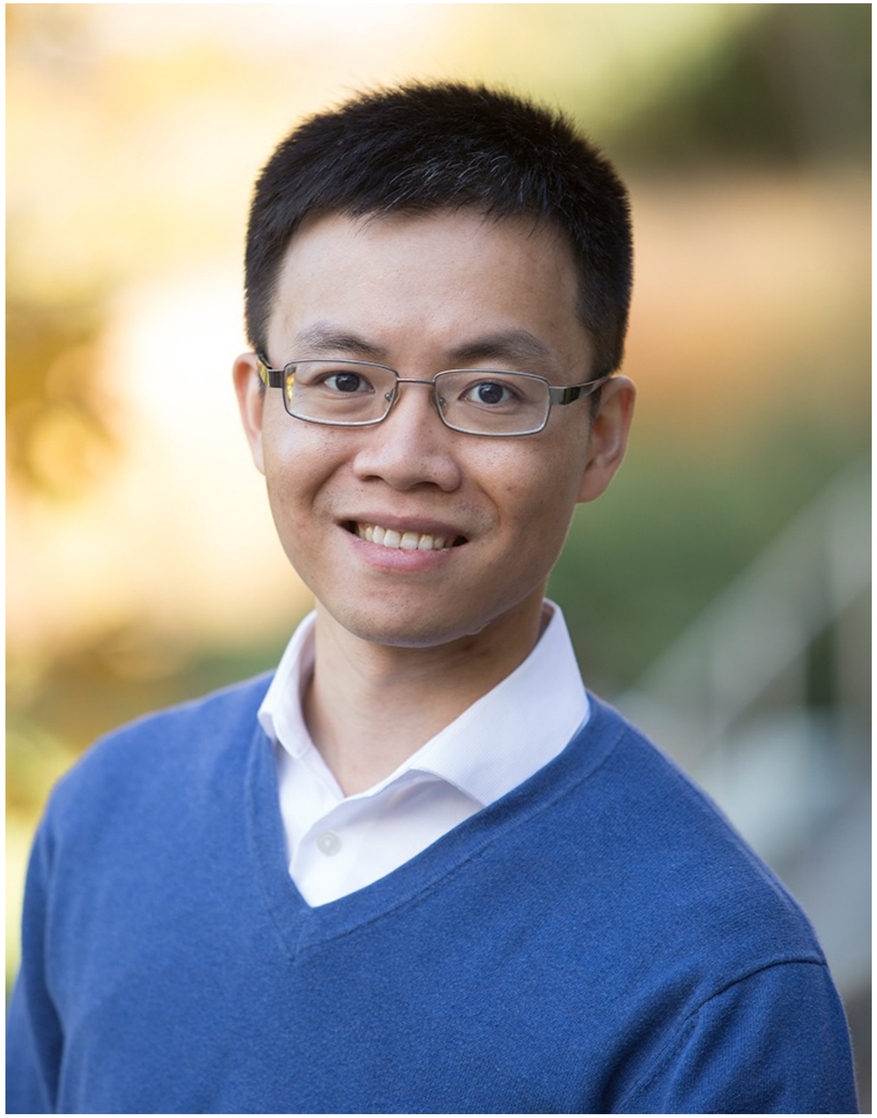
- Introduction to "Introduction to Artificial Intelligence"
- Course logistics
- Python overview
- Probability basics

Instructor

- Prof. Yudong Chen

  Email: yudong.chen@wisc.edu

  Office: 5373 Computer Sciences



Use piazza for questions:

http://piazza.com/wisc/fall2021/cs5403

For emails, please include [**CS540**] in the subject title :)

Part I: Course overview

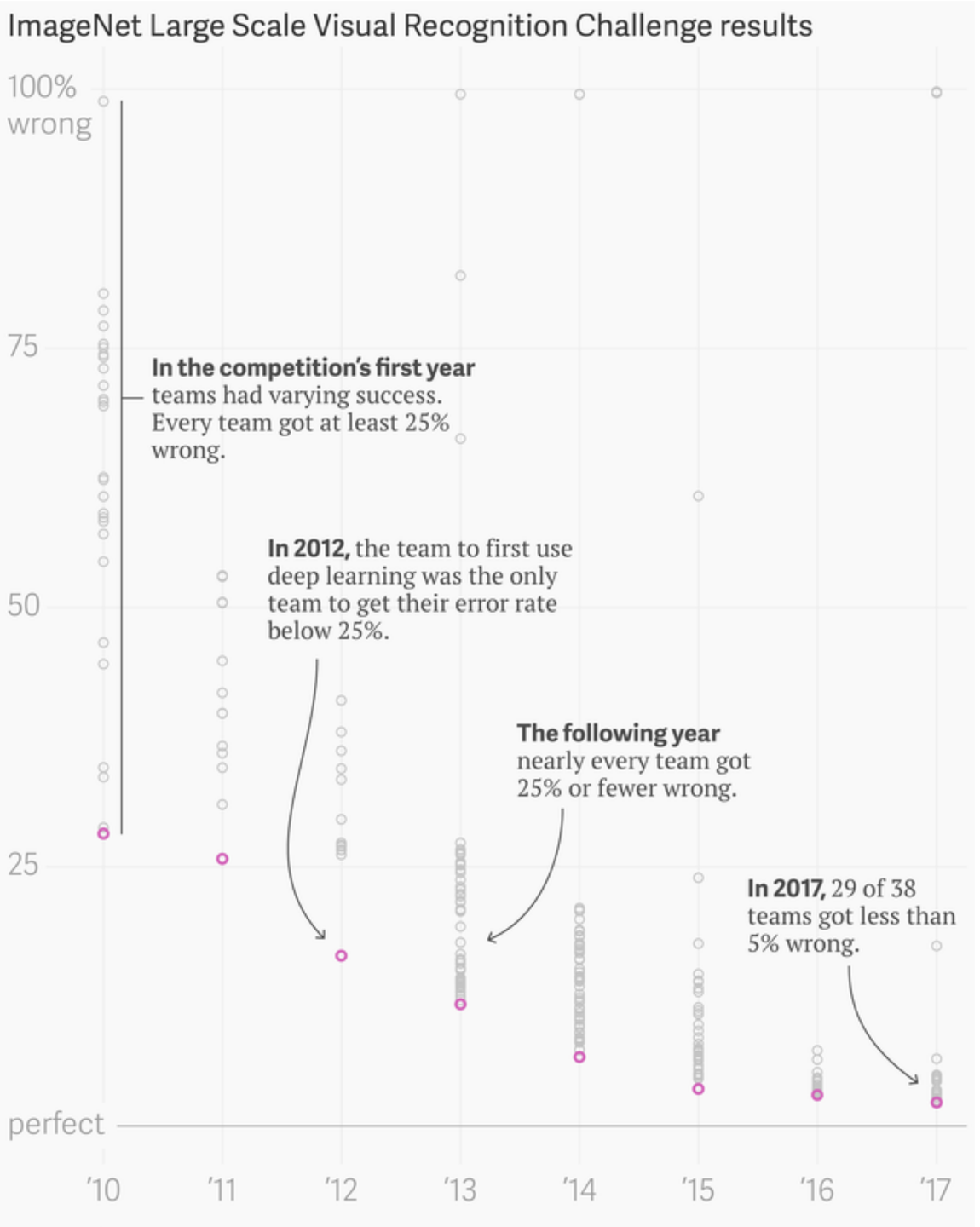

AI

Classify Images

http://www.image-net.org/

Classify Images

https://qz.com/1034972/the-data-that-changed-the-direction-of-ai-research-and-possibly-the-world/



Detect and Segment Objects

https://github.com/matterport/Mask_RCNN

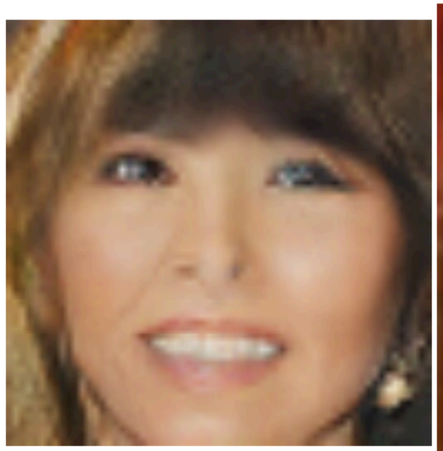
Style Transfer

https://github.com/StacyYang/MXNet-Gluon-Style-Transfer

Generative Modeling

4.5 years of face generation

2014



2015

2016

2017

2018

Artificial Image Synthesis

Synthesize the images

http://www.whichfaceisreal.com/methods.html

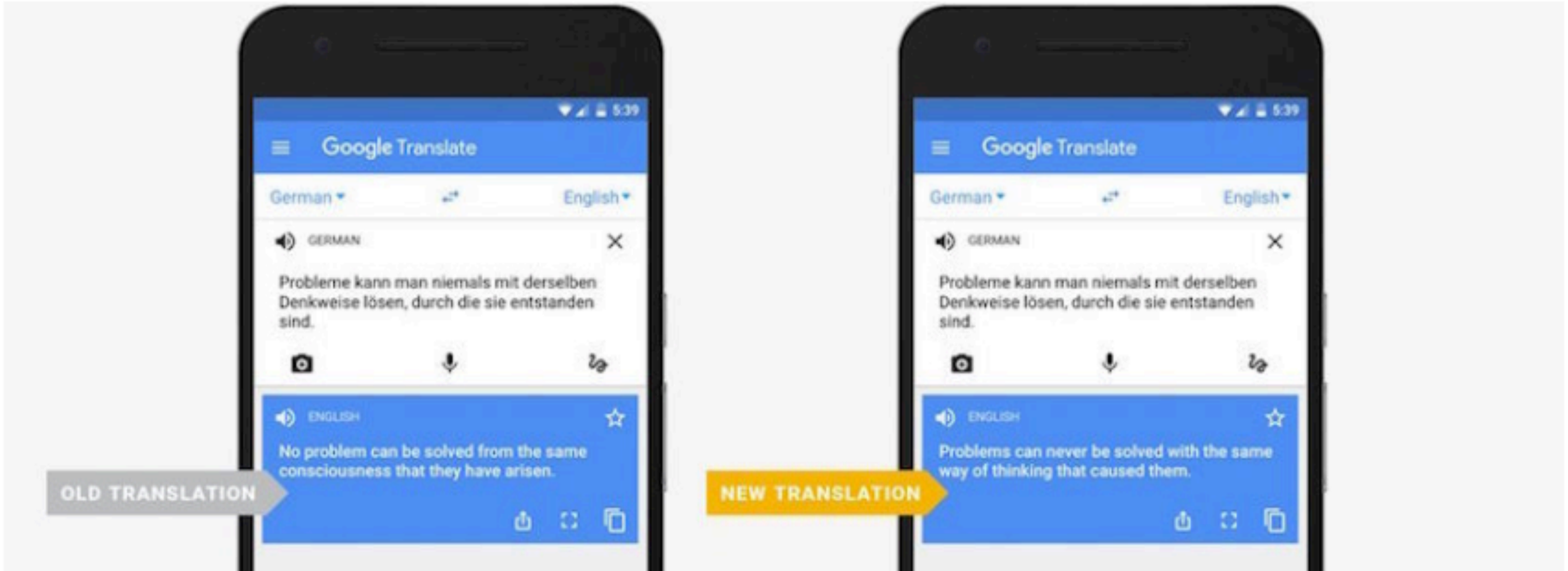
Machine Translation

https://www.pcmag.com/news/google-expands-neural-networks-for-language-translation

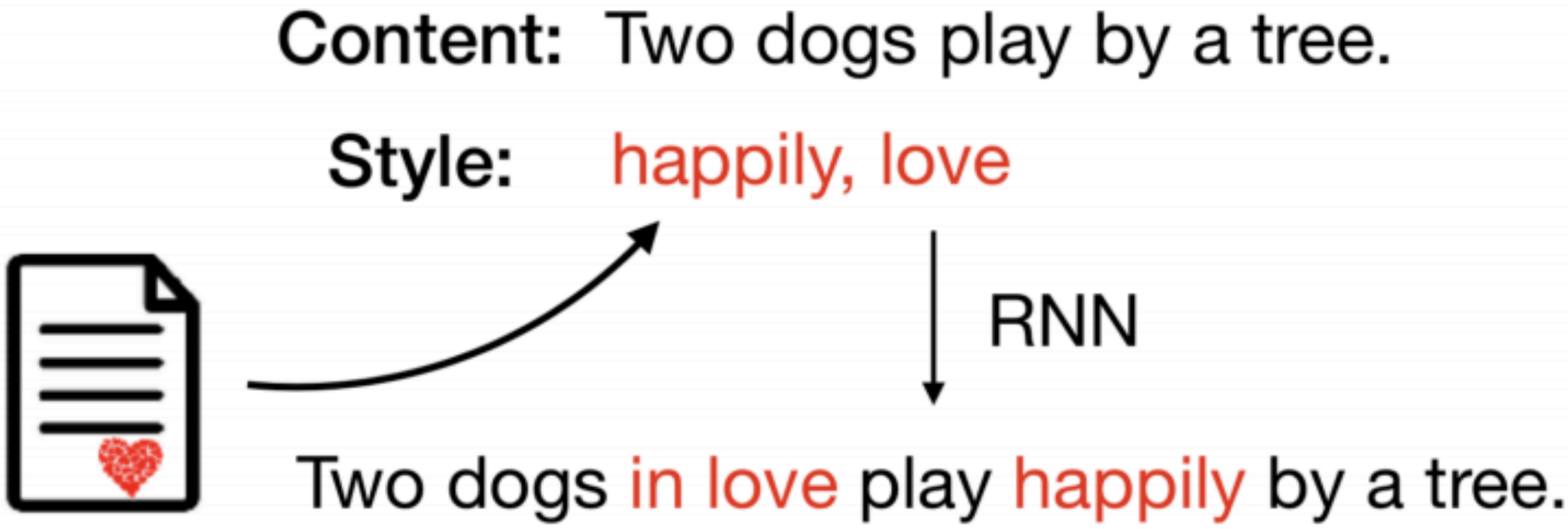
Google Expands Neural Networks for Language Translation

The new system can translate whole sentences at a time, rather than just phrases.

By Tom Brant November 15, 2016



Text Synthesis

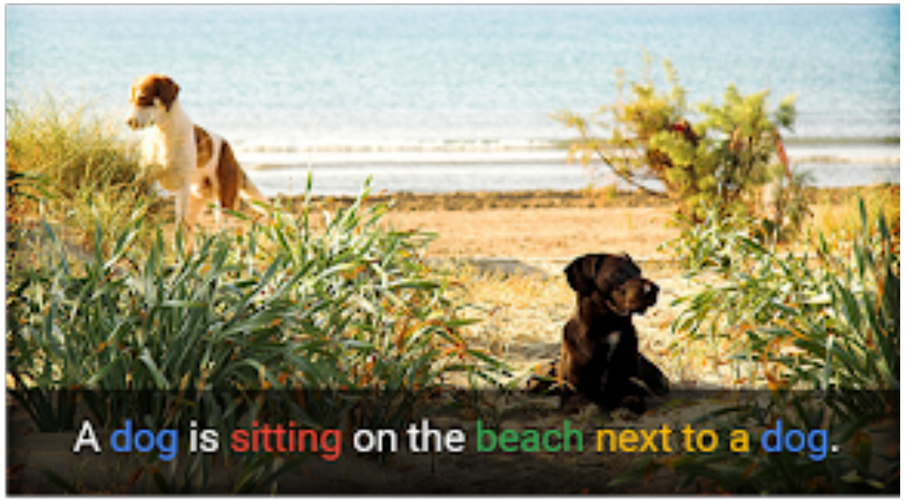


Li et al, NACCL, 2018

Image Captioning

Human captions from the training set

Automatically captioned



https://ai.googleblog.com/2016/09/show-and-tell-image-captioning-open.html

Open AI GPT-3: Giving GPT-3 a Turing Test

Q: What is your favorite animal?
A: My favorite animal is a dog.

Q: Why?
A: Because dogs are loyal and friendly.

Open AI GPT-3: Giving GPT-3 a Turing Test

Q: What is your favorite animal?
A: My favorite animal is a dog.

Q: Why?
A: Because dogs are loyal and friendly.

Q: What are two reasons that a dog might be in a bad mood?
A: Two reasons that a dog might be in a bad mood are if it is hungry or if it is hot.

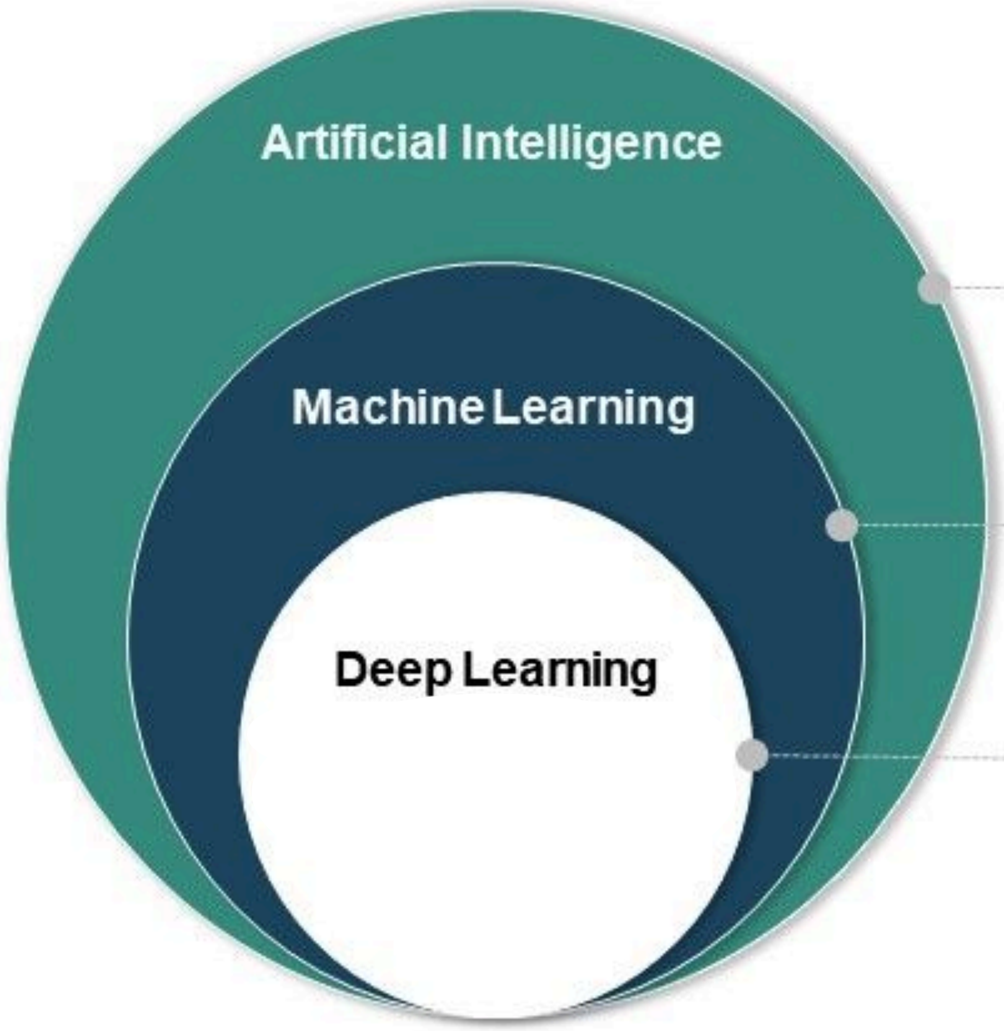
Q: How many eyes does a giraffe have?
A: A giraffe has two eyes.

Q: How many legs does a frog have?
A: A frog has four legs.

Q: Are there any animals with three legs?
A: No, there are no animals with three legs.

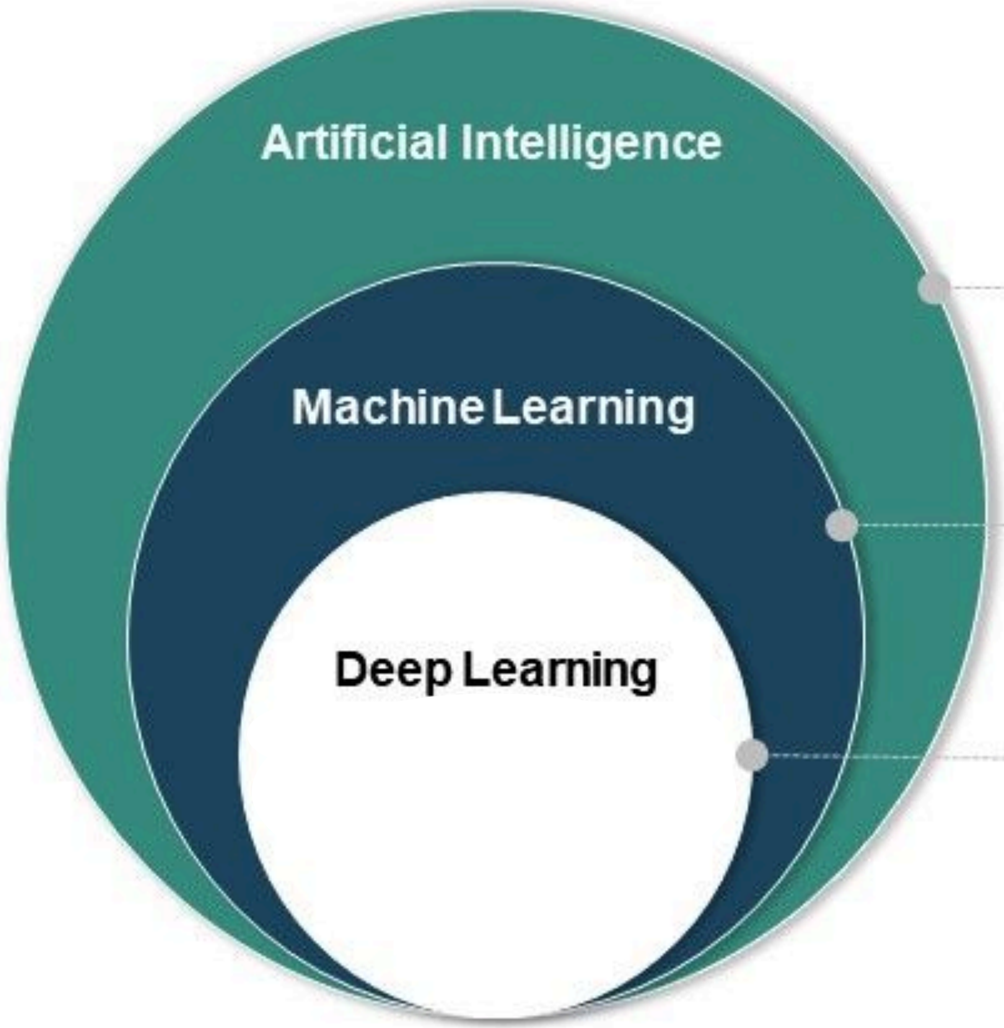
Q: Why don't animals have three legs?
A: Animals don't have three legs because they would fall over.

What is Artificial Intelligence (AI)?



Artificial Intelligence
Any technique which enables computers to mimic behavior.

What is Artificial Intelligence (AI)?



Artificial Intelligence
Any technique which enables computers to mimic behavior.

Machine Learning
Subset of AI techniques which use statistical methods to enable machines to improve with experiences.

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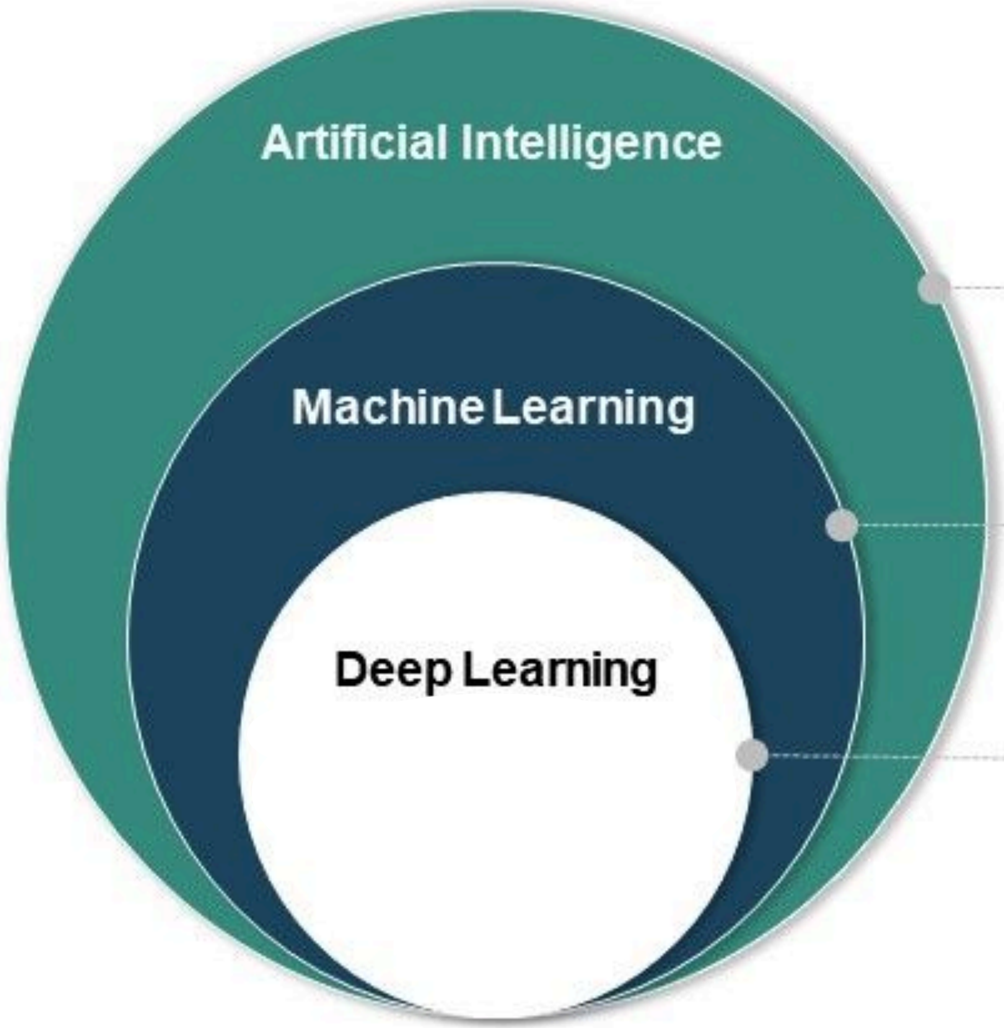


Artificial Intelligence
Any technique which enables computers to mimic behavior.

Machine Learning
Subset of AI techniques which use statistical methods to enable machines to improve with experiences.

Deep Learning
Subset of ML which make the computation of multi-layer neural networks feasible.

Artificial Intelligence is not Magic

They rely on **fundamental** techniques in:

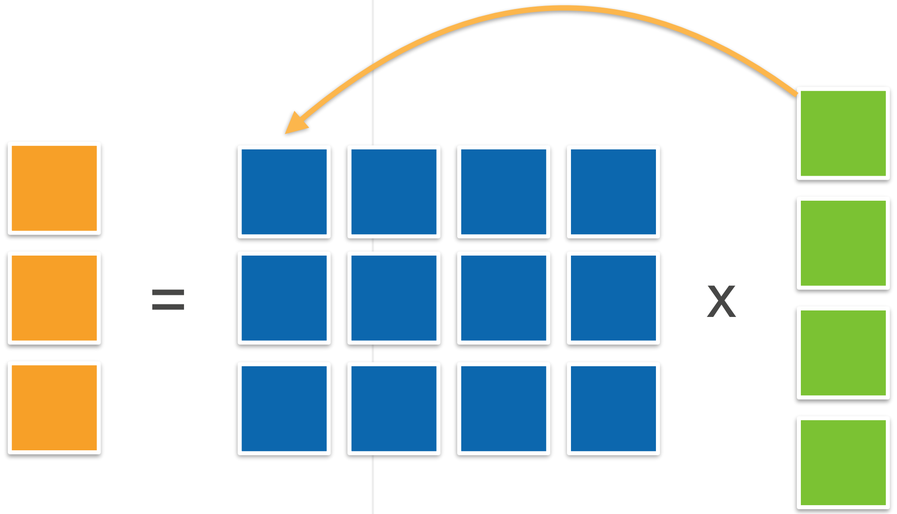
- Algorithms
- Mathematics
- Logic
- Probability and Statistics
- Optimization

What you can learn from CS540?

https://pages.cs.wisc.edu/~yudongchen/cs540_3_fall21/schedule.html

Date	Topic	Reading materials	Assignments
Thursday, Sept 9	(Class Canceled)	Python Crash Course (self-study)	HW1 Released
Tuesday, Sept 14	Course Overview and Probability		
Thursday, Sept 16	Linear Algebra and PCA		
Tuesday, Sept 21	Statistics and Math Review		HW1 Due
Thursday, Sept 23	Introduction to Logic		
Tuesday, Sept 28	Natural Language Processing		
Thursday, Sept 30	Machine Learning: Introduction		
Tuesday, Oct 5	Machine Learning: Unsupervised Learning I		
Thursday, Oct 7	Machine Learning: Unsupervised Learning II		
Tuesday, Oct 12	Machine Learning: Linear regression		
Thursday, Oct 14	Machine Learning: K - Nearest Neighbors & Naive Bayes		
Tuesday, Oct 19	Machine Learning: Neural Network I (Perceptron)		
Thursday, Oct 21	Machine Learning: Neural Network II		

Foundations



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Machine learning

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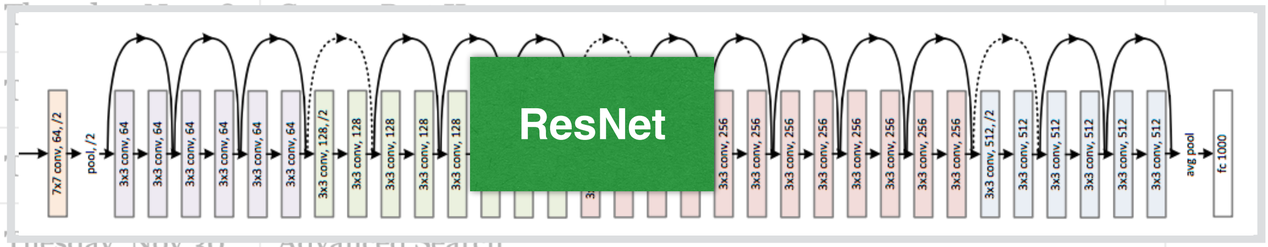
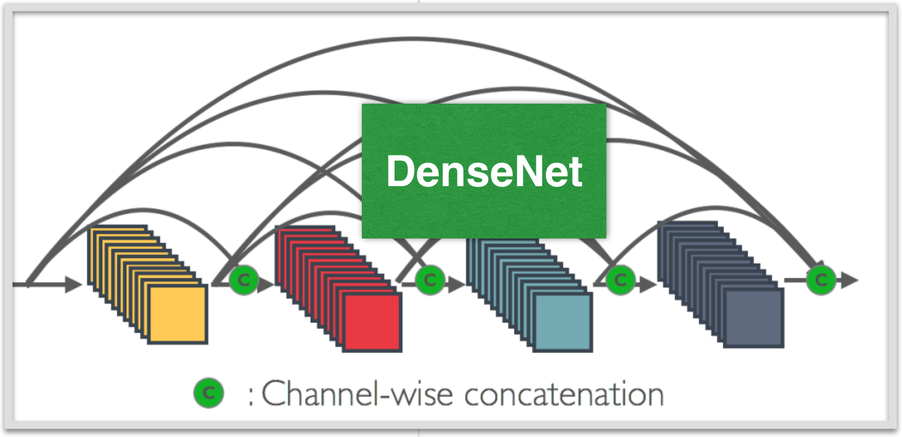
Tuesday, Oct 19	Machine Learning: Neural Network I (Perceptron)
Thursday, Oct 21	Machine Learning: Neural Network II
Tuesday, Oct 26	Machine Learning: Neural Network III
MIDTERM EXAM: Thursday, Oct 28	
Tuesday, Nov 2	Machine Learning: Deep Learning I
Thursday, Nov 4	Machine Learning: Deep Learning II
Tuesday, Nov 9	Machine Learning: Deep Learning III
Thursday, Nov 11	Machine Learning: Deep Learning and Neural Network's Summary
Tuesday, Nov 16	Game - Part I
Thursday, Dec 2	Introduction to Reinforcement Learning

Deep Learning





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Thursday, Nov 4	Machine Learning: Deep Learning II
Tuesday, Nov 9	Machine Learning: Deep Learning III
Thursday, Nov 11	Machine Learning: Deep Learning and Neural Network's Summary
Tuesday, Nov 16	Game - Part I
Thursday, Nov 18	Game - Part II
Tuesday, Nov 23	Search I: Un-Informed search
Thursday, Nov 25	Search II: Informed search
Tuesday, Nov 30	Advanced Search
Thursday, Dec 2	Introduction to Reinforcement Learning
Tuesday, Dec 7	Reinforcement Learning and Search Summary
Thursday, Dec 9	Ethics and Trust in AI
Tuesday, Dec 14	Artificial Intelligence in the Real World

Game, search and RL

What you can learn from CS540?

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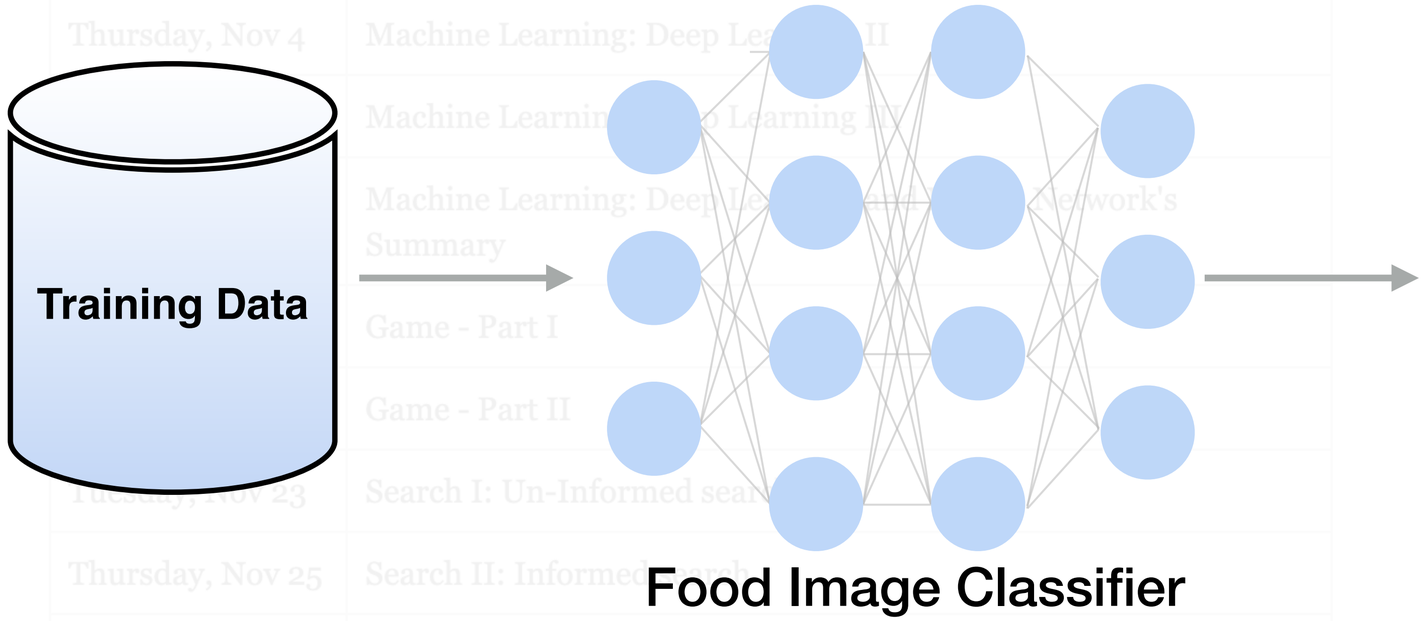

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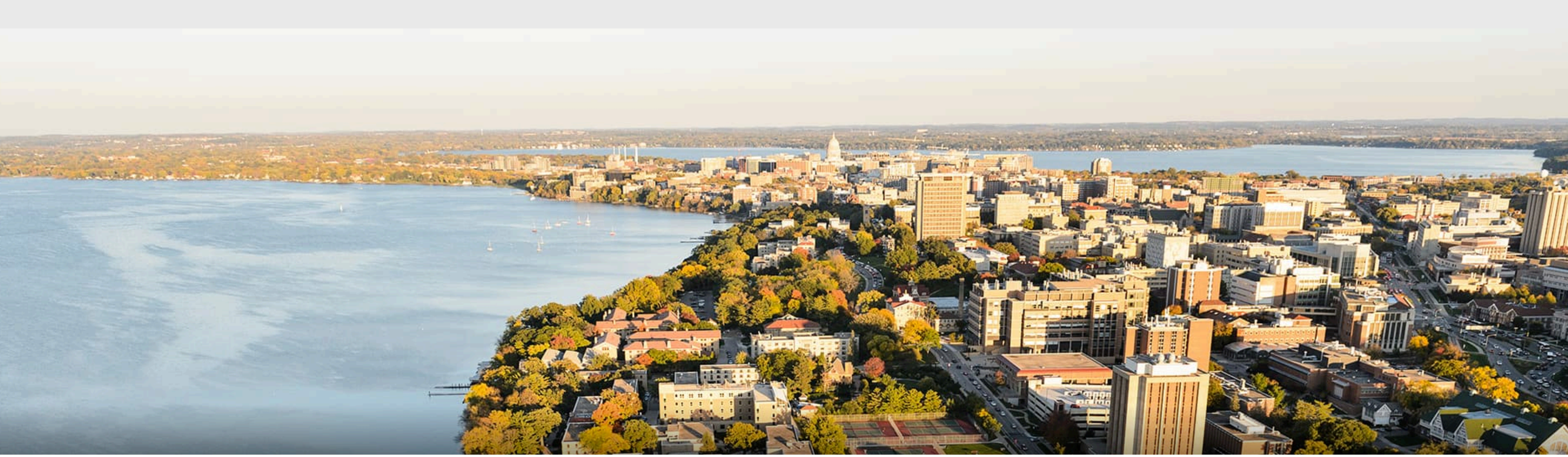
Real-world AI



Part II: Course Logistics

Course Schedule

- Time: **Tuesday** and **Thursday** 4:00-5:15pm CT
- Location: **Noland Hall 132**
- Schedule is available on the course website:

  https://pages.cs.wisc.edu/~yudongchen/cs540_3_fall21/
- Slides online on website

Lecture

- Each lecture will be a series of short blocks.

- In each block, we will
  - Lecture using slides or a whiteboard
  - Pause for interactive Q&A
  - Deliver short quiz questions to clear up any confusion before proceeding to the next block.

- **If you're experiencing any symptoms of Covid or have been exposed to someone who tested positive for Covid, please do not attend lecture.**

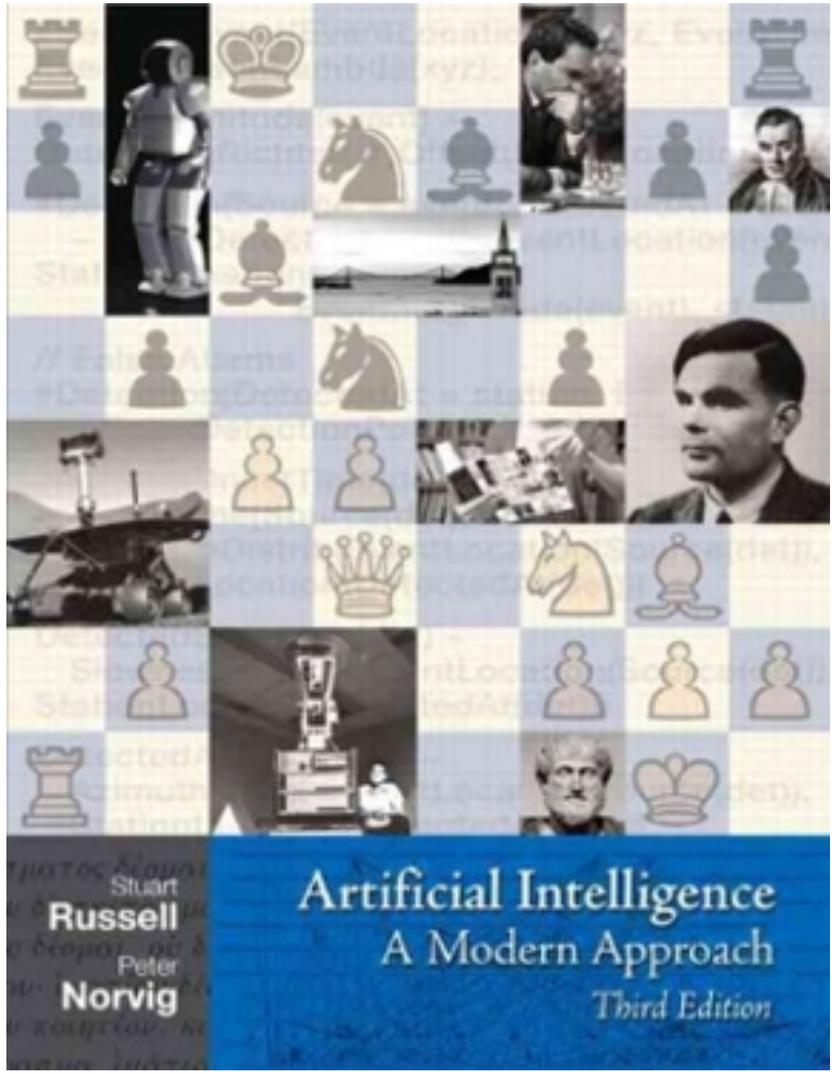
- No penalty for not attending lecture.

Where to find content?

- **Piazza** http://piazza.com/wisc/fall2021/cs5403
  - Discussion, questions
  - Announcements
- **Canvas** - private materials *that should not be shared*
  - Videos
  - Assignments
  - Grades
- **Course website** - public materials https://pages.cs.wisc.edu/~yudongchen/cs540_3_fall21/
  - Slides
  - Schedule
  - Policies

Textbook

Artificial Intelligence: A Modern Approach (4th edition). Stuart Russell and Peter Norvig. Pearson, 2020. ISBN 978-0134610993. **(textbook is optional, but may be useful)**



Teaching Assistants

Yunhan Hu

hu342@wisc.edu

Samarth Mathur

mathur9@wisc.edu

Peer Mentors

- 12 Peer mentors
  - See course website for office hours:

    https://pages.cs.wisc.edu/~yudongchen/cs540_3_fall21/office_hours.html

  - Shared across 3 course sections

Office Hours

- Available on the course website
- Use Peer Mentor hours for detailed-level questions (e.g. coding related)
- Use TA office hours for conceptual level questions

Grading scheme

- **Midterm Exam**: 15% (October 28)
- **Final Exam**: 15% (December 20)
- **Homework Assignments**: 70% (10 HWs)

  TWO lowest homework scores are dropped from the final homework average calculation.

  Homework is due the minute before class starts on the due date.
  (Late submissions will not be accepted.)

  Homework will be posted and submitted via Canvas.

Regrade Request

Use Google Form for regrade request

Raised with the TAs within 72 hours after it is returned.

Entire assignment will be regraded. (Your grade may go up or down.)

Academic Integrity

https://pages.cs.wisc.edu/~yudongchen/cs540_3_fall21/about.html

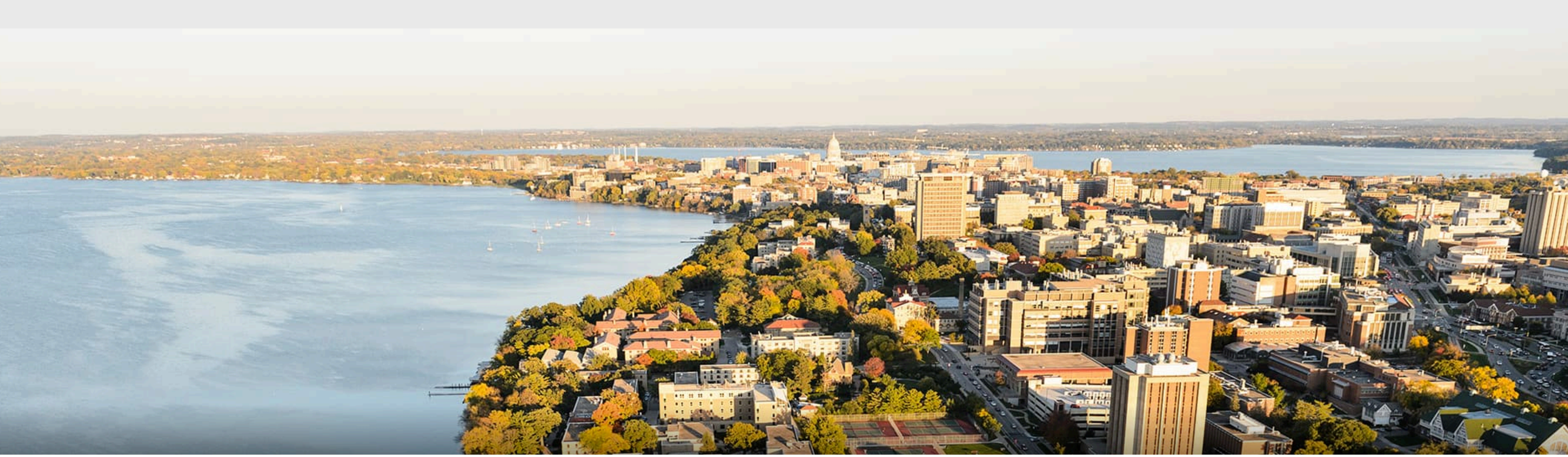
You are encouraged to discuss with your peers, the TA or the instructors ideas, approaches and techniques broadly. However, all examinations, programming assignments, and written homeworks must be written up individually. For example, code for programming assignments must not be developed in groups, nor should code be shared. Make sure you work through all problems yourself, and that your final write-up is your own. If you feel your peer discussions are too deep for comfort, declare it in the homework solution: "I discussed with X,Y,Z the following specific ideas: A, B, C; therefore our solutions may have similarities on D, E, F...".

You may use books or legit online resources to help solve homework problems, but you must always credit all such sources in your writeup and you must never copy material verbatim.

We are aware that certain websites host previous years' CS540 homework assignments and solutions against the wish of instructors. Do not be tempted to use them: the solutions may contain "poisonous berries" previous instructors planted intentionally to catch cheating. If we catch you copy such solutions, you automatically fail.

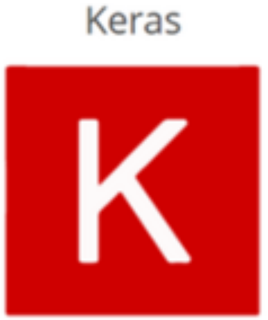
Do not bother to obfuscate plagiarism (e.g. change variable names, code style, etc.) One application of AI is to develop sophisticated plagiarism detection techniques!

Cheating and plagiarism will be dealt with in accordance with University procedures (see the UW-Madison Academic Misconduct Rules and Procedures)



Part III: Software

Tools



- **Python**
  - Everyone is using it in machine learning & data science
  - Conda package manager (for simplicity)

- **Jupyter**
  - Much easier to keep track of your experiments
  - Obviously you should put longer code into modules

Python for Java Pros (slides available on website)

https://pages.cs.wisc.edu/~yudongchen/cs540_3_fall21/documents/python.pptx

A Crash Course in Python

1. Why are we doing this in Python?
2. Where do I write Python code? How do I run it?
   a. Online
   b. Offline
3. What are the big differences between Java and Python

Colab

- Go to colab.research.google.com
- Activate the GPU supported runtime (this is a K80 GPU)

What's Next

- **Rest of today:** Probability Basics
- **Next lecture:** Linear Algebra and PCA

- ML loves probability, vectors and matrices!