Course Summary

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University of Colorado Boulder
Spring 2025

https://dannagurari.colorado.edu/course/neural-networks-and-deep-learning-spring-2025/

Review

- Last lectures
  - Guest lectures
- Assignments (Canvas)
  - Final project presentation due earlier today
  - Peer evaluation due on Thursday
  - Final project due a week from tomorrow (Wednesday)
- Questions?

Today’s Topics

- Reflections: what we have done over the semester
- Key takeaways: lessons from the past 68 years
- Looking ahead: how to continue with NN and DL
- Open Q&A with instructor
- Closing remarks

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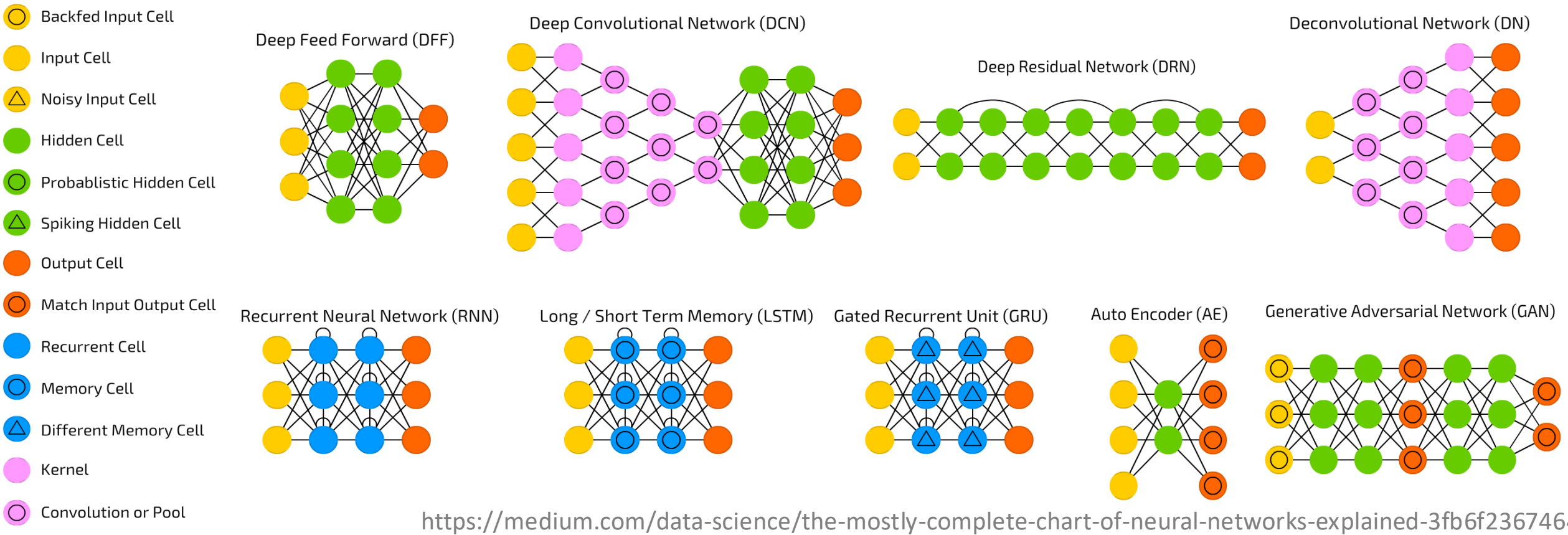
Recall, we heard in lecture 1 that
we have 3 objectives for this course

Course Objective 1: Understand Key Concepts for Designing Deep Learning Models

A. Characterized key neural network architectures; what are they?
- Latest architecture: transformers
- Pioneering architectures covered:



https://medium.com/data-science/the-mostly-complete-chart-of-neural-networks-explained-3fb6f2367464

Course Objective 1: Understand Key Concepts for Designing Deep Learning Models

A. Characterized key neural network architectures

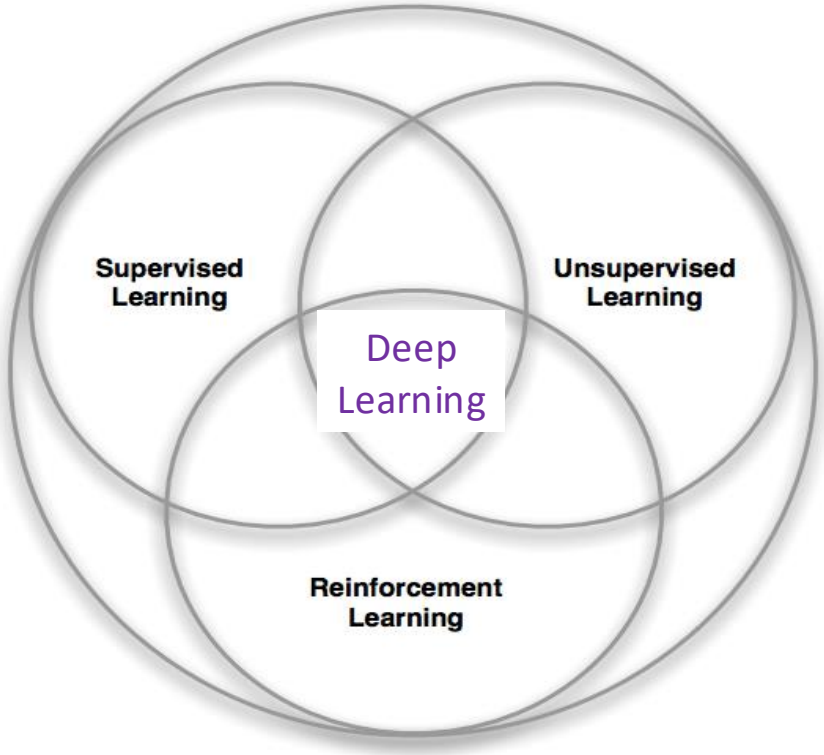
B. Identified strengths and weaknesses of different architectures; what are they?
   - CNNS great for spatial data
   - RNNs great for sequential data
   - Transformers great for all data types, but very computationally and data hungry
   - And more, covered in four problem sets, lectures, and assigned readings

Course Objective 1: Understand Key Concepts for Designing Deep Learning Models

A. Characterized key neural network architectures

B. Identified strengths and weaknesses of different architectures

C. Identified techniques for training and evaluating deep learning models
   - Gradient descent
   - Learning approaches:



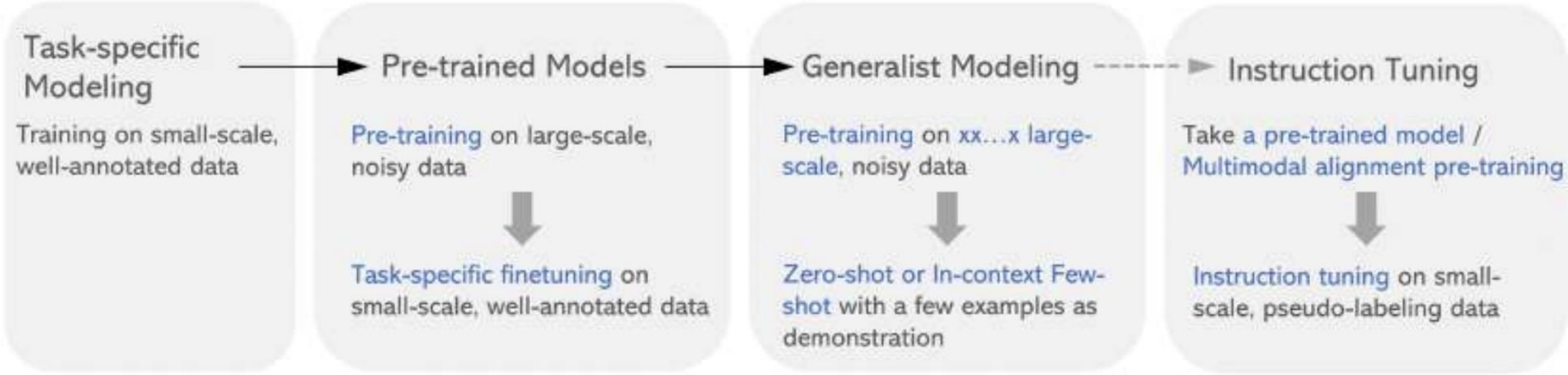
http://www0.cs.ucl.ac.uk/staff/d.silver/web/Teaching_files/intro_RL.pdf

Course Objective 1: Understand Key Concepts for Designing Deep Learning Models

A. Characterized key neural network architectures

B. Identified strengths and weaknesses of different architectures

C. Identified techniques for training and evaluating deep learning models
   - Gradient descent
   - Learning approaches
   - Learning evolution:



https://www.thetalkingmachines.com/sites/default/files/2023-09/2309.10020_compressed.pdf

Course Objective 2: Apply Deep Learning Models to Perform Various AI Tasks

A. Experimented with established deep learning libraries
   - 15 coding tutorials focused mostly on PyTorch, but covering more (e.g., Hugging Face)

B. Developed deep learning models from scratch
   - 3 lab assignments covering single and multi-modality tasks for working with “deep” architectures and “big data”

C. Evaluated deep learning models for diverse tasks, especially for analyzing text and images

Course Objective 3: Conduct and Communicate About a Novel Project

A. Proposed a novel project idea
B. Designed and executed experiments to support the proposed idea
C. Created a presentation about the project
D. Writing a report about the project (due in ~1 week)

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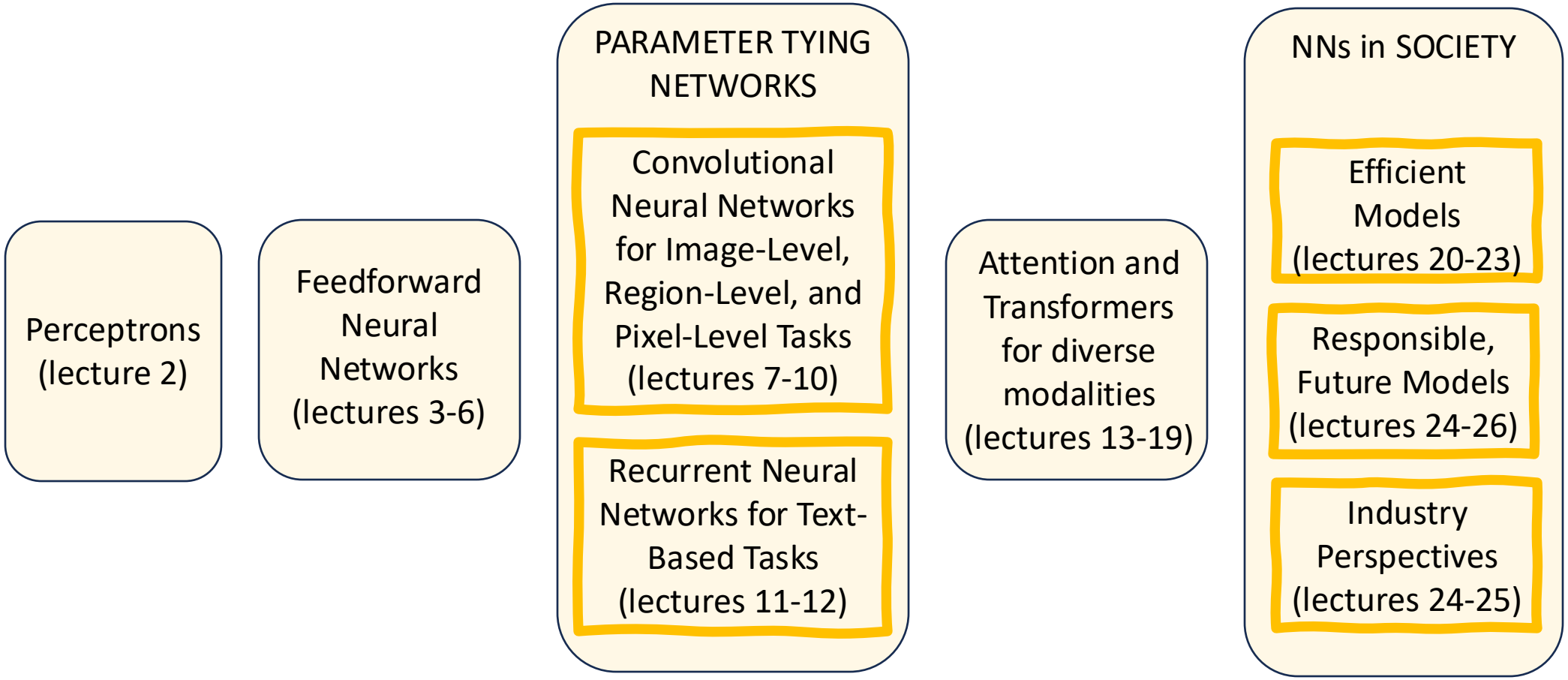
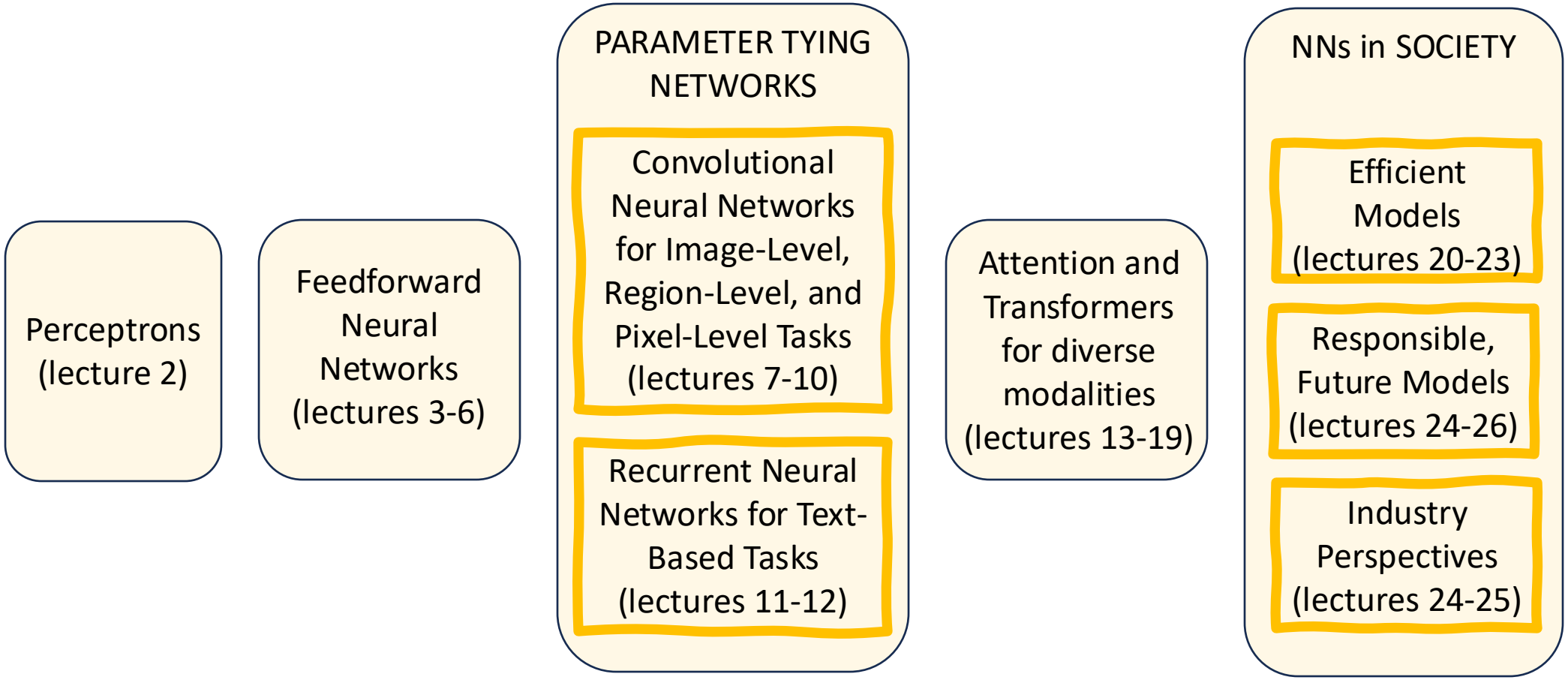
Recalls Rise/Falls of Neural Network Popularity

Evolution Over Past 68 Years



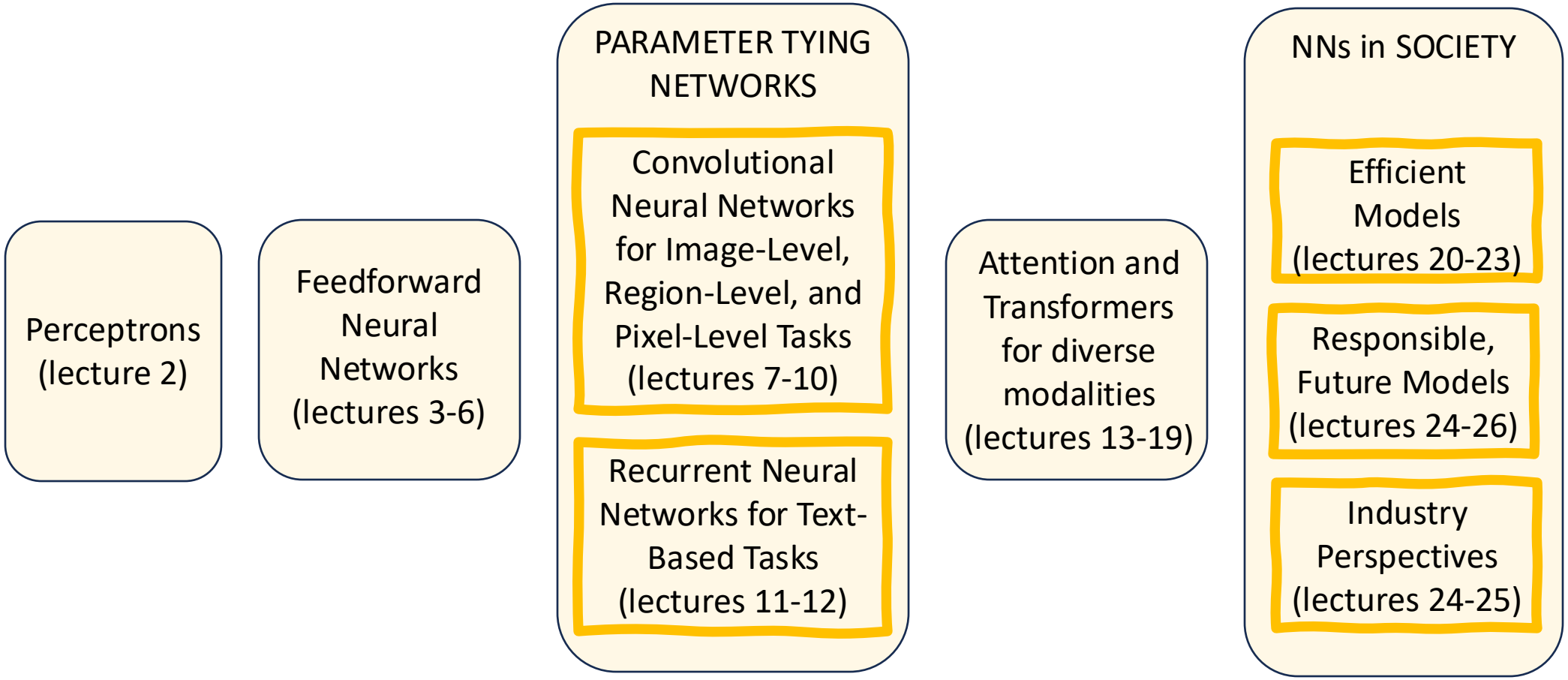
Dominant architectures changed, suggesting new one will emerge (if not yet here)

Evolution Over Past 68 Years



Learning evolved from primarily human-supervision to self-supervision, suggesting a new norm for supervision may emerge (if not yet here)

Evolution Over Past 68 Years



Models moving from supporting single to multiple modalities

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Ways to Stay Connected with NN & DL

- Many courses at CU Boulder
- Read research papers: e.g., on arXiv and Google Scholar
- Attend workshops and conferences: e.g., NeurIPS, ICML, CVPR, EMNLP
- Follow relevant social media feeds: e.g., leading thinkers and labs in academia and industry; e.g., Epoch AI (https://epoch.ai/)
- Follow AI news sources; e.g., There's an AI For That (https://theresanaiforthat.com/)

Get Involved at CU Boulder

- Apply to join research efforts… see Canvas announcement

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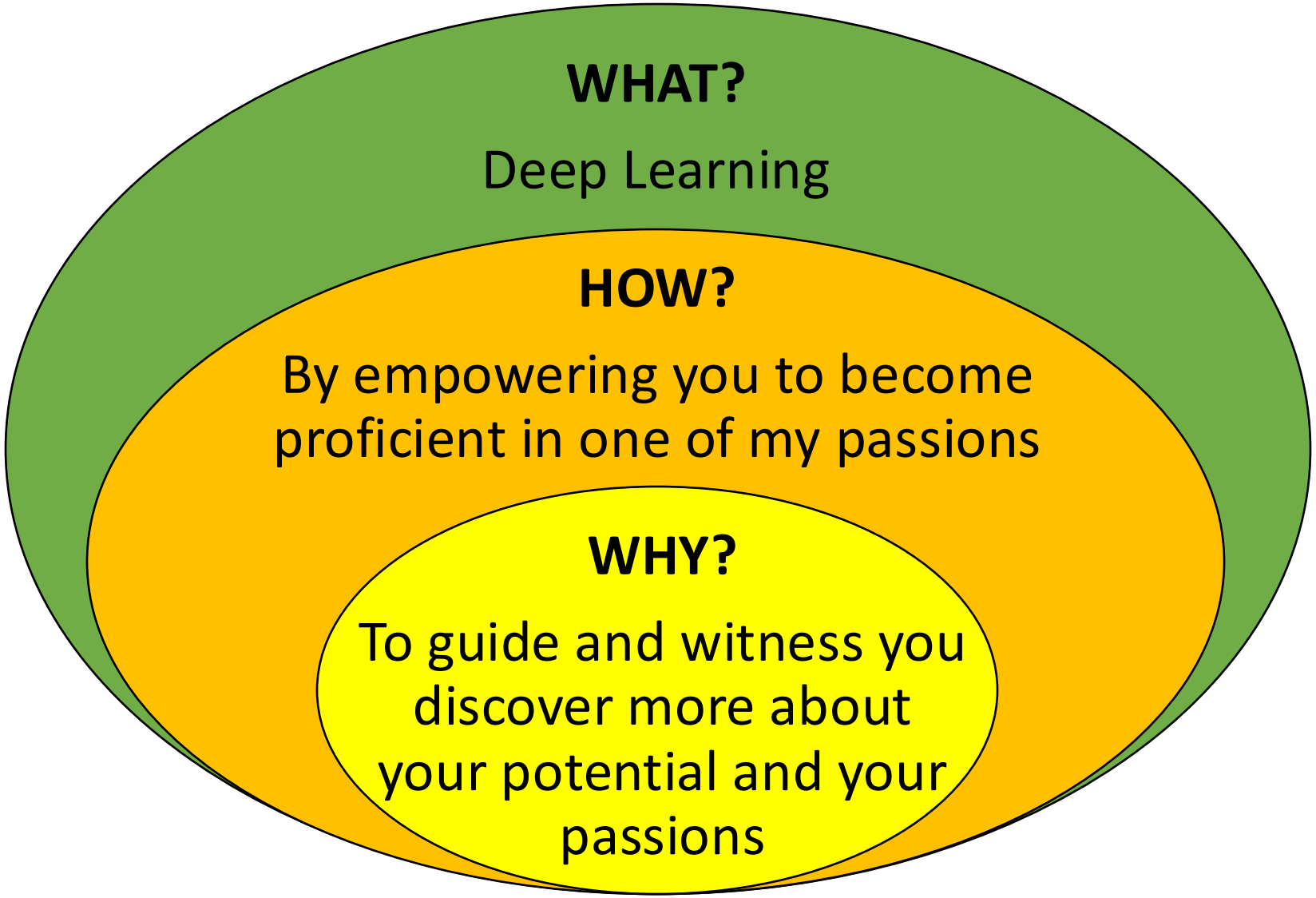
Thursday's Online "Conference"

- GatherTown: open from 12:00am to 11:59pm

- Peer evaluation: each person must provide 3 types of feedback for assigned room
  - A rose: What do you think was the highlight or biggest success of this project?
  - A thorn: What was a challenge or weakness in their project that you think needs to be addressed?
  - A bud: What are the implications of their project for future research?

Recall My “Why” for Teaching You…



It’s been a pleasure teaching each of you.

Thank you for choosing to take this course.

I look forward to seeing your presentations on Thursday!

Feel free to stay connected via LinkedIn ☺

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The End