

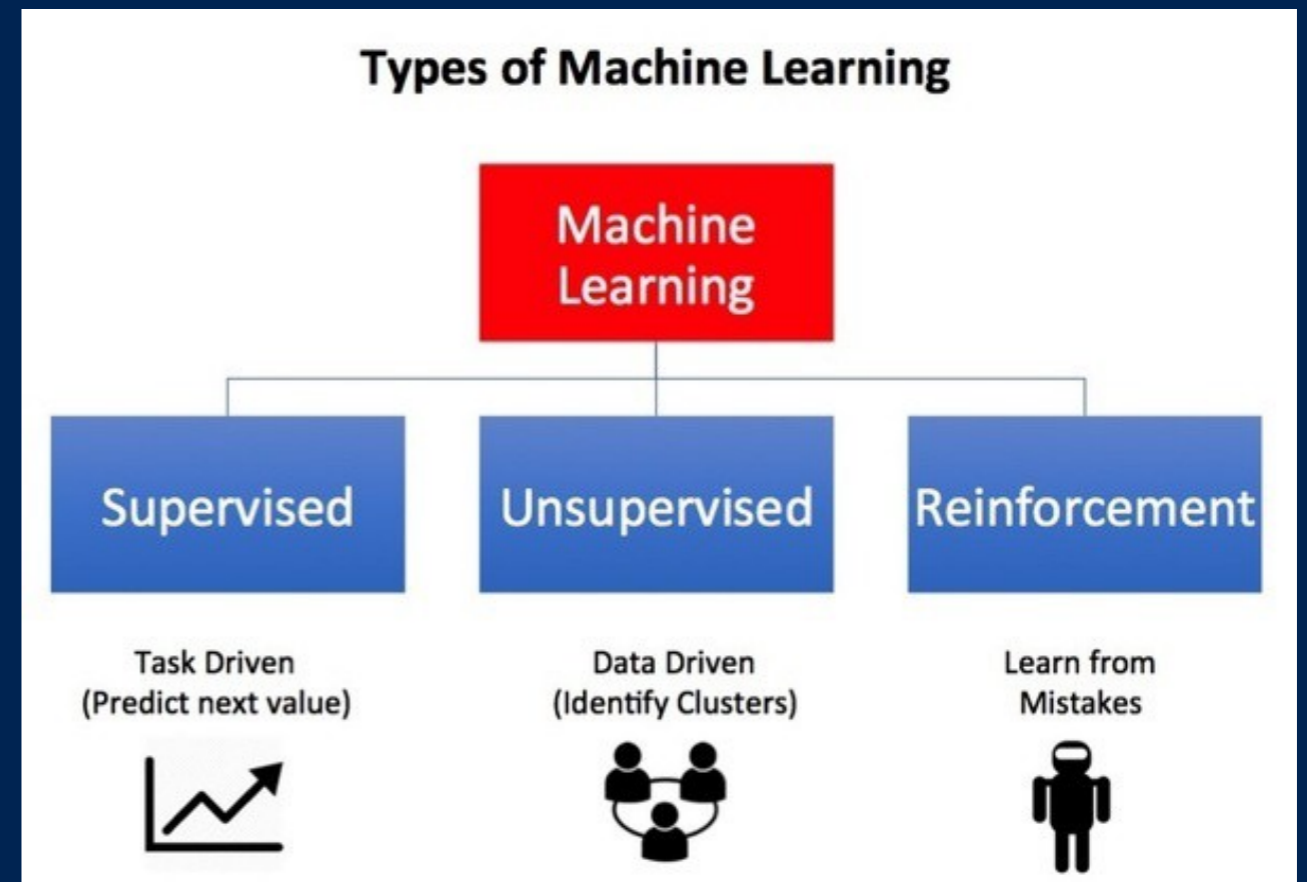
# introduction to machine learning

[brettkoonce.com/talks](http://brettkoonce.com/talks)

march 7th, 2019

# overview

- machine learning vs ai
- unsupervised learning, supervised learning
- neural networks, convolutions, recurrence
- adversarial networks, reinforcement learning



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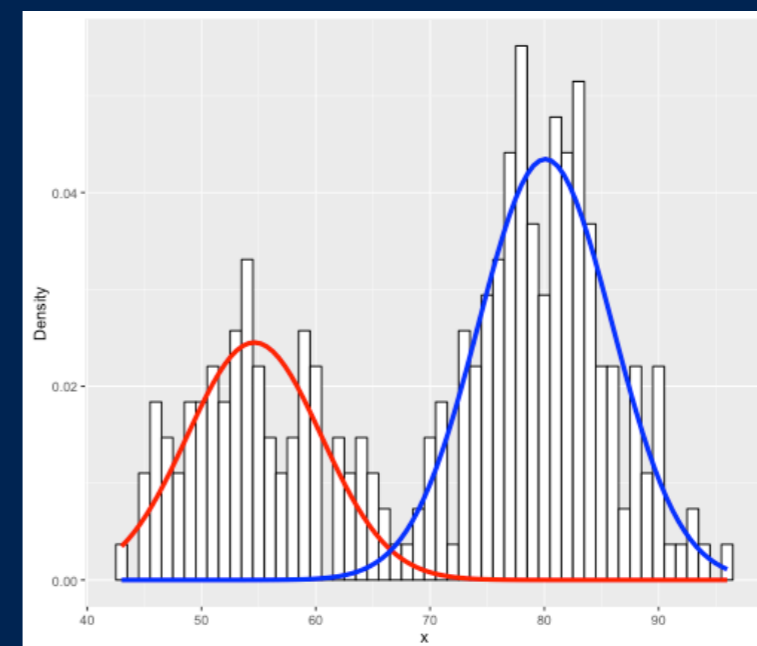
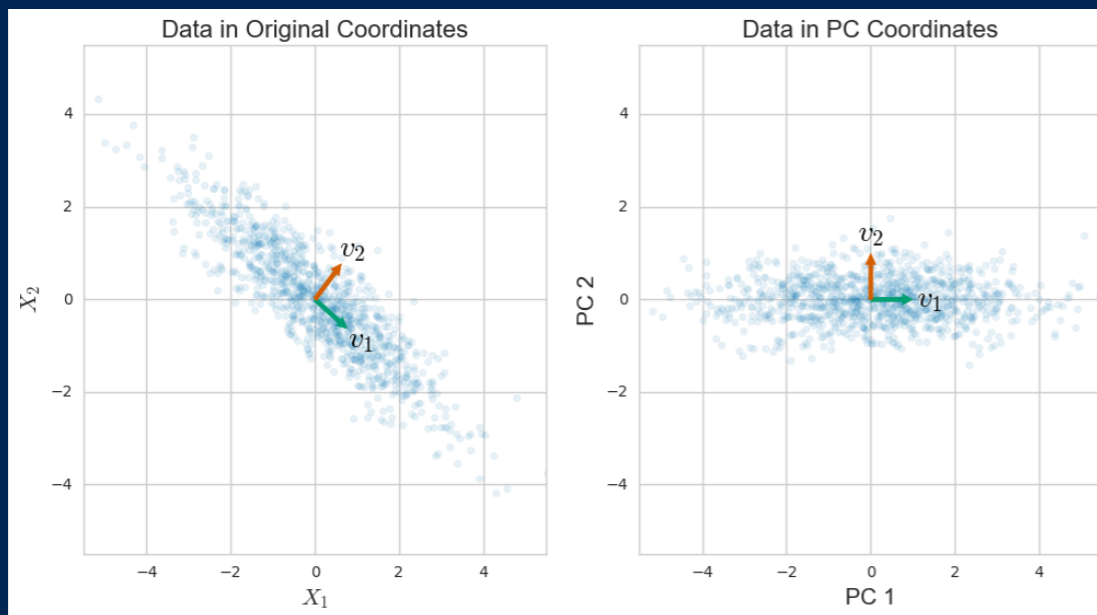
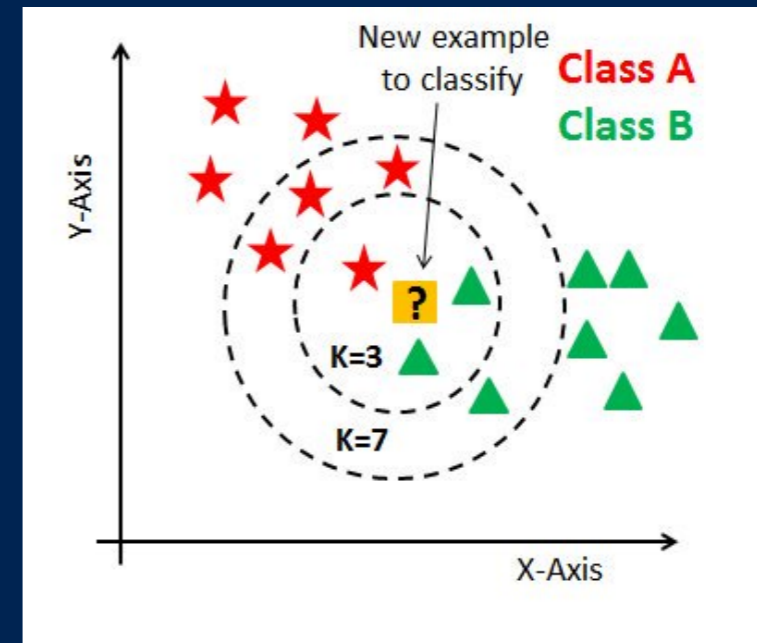
# ml vs ai

- $rl \subset dl \subset ml \subset ai \subset \text{universe}$
- computer: xth digit of  $\pi$ ?
- human: is there a cat in this picture?
- neither: what is meaning of life?



# unsupervised learning

- knn, clustering
- pca/svd
- mixture models, kernel methods

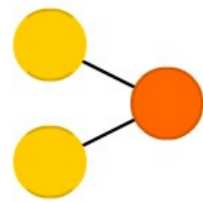




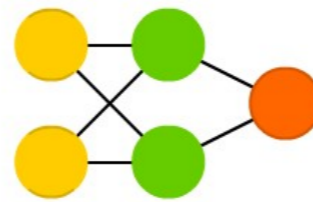
# neural networks

- Input Cell
- Hidden Cell
- Output Cell
- Kernel
- Convolution or Pool

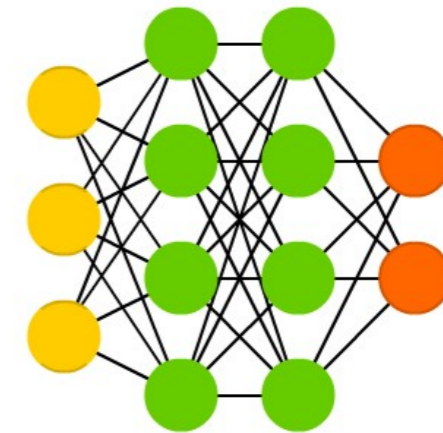
Perceptron (P)



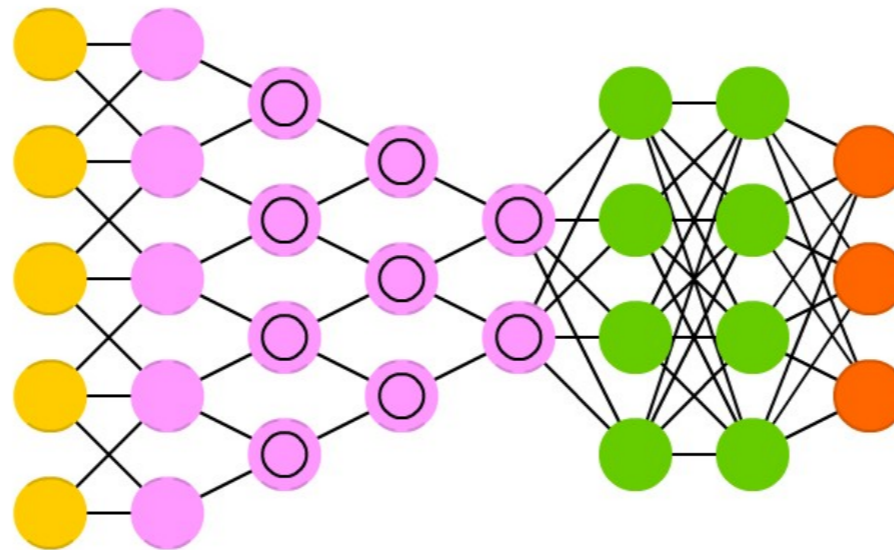
Feed Forward (FF)



Deep Feed Forward (DFF)



Deep Convolutional Network (DCN)



# convolutional neural networks

## Other Computer Vision Tasks

**Semantic Segmentation**



GRASS, CAT,  
TREE, SKY

No objects, just pixels

**Classification + Localization**



CAT

Single Object

**Object Detection**



DOG, DOG, CAT

Multiple Object

**Instance Segmentation**



DOG, DOG, CAT

This image is CC0 public domain

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# recurrent neural networks

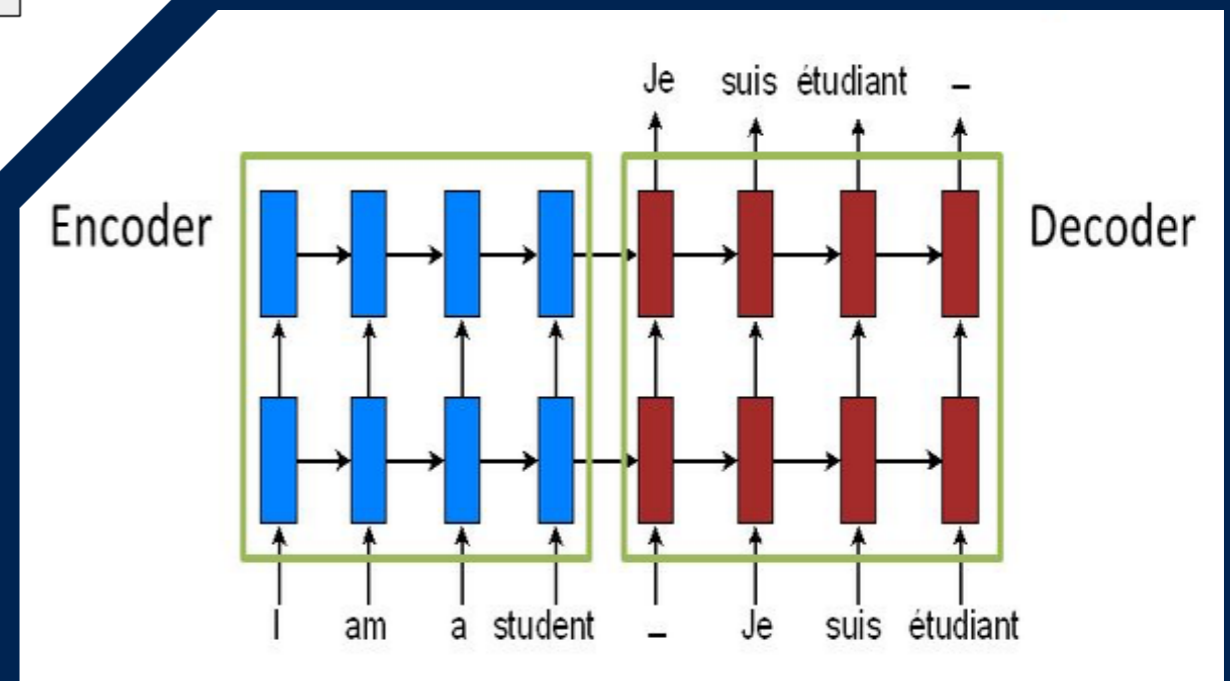
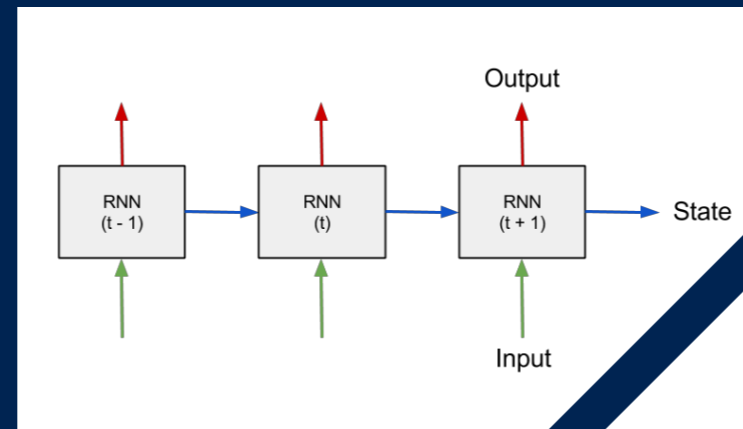
- **rnn, lstm**

- **attention mechanisms**

- **sentiment analysis**

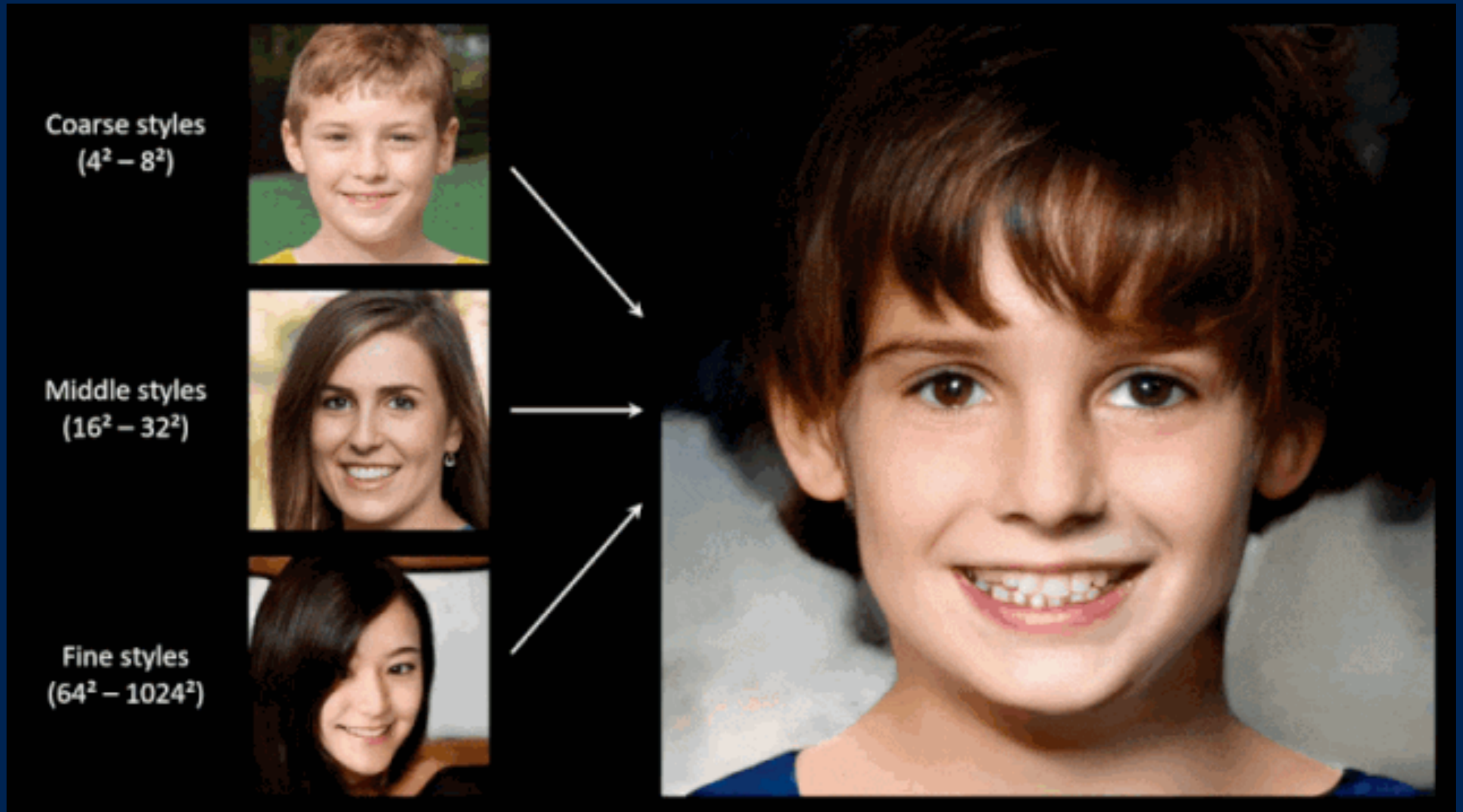
- **neural machine translation**

- **convert rnn  $\rightarrow$  cnn, combined cnn + rnn**





# generative adversarial networks (gan)



# reinforcement learning

- **model the data ourselves → much faster**
- **recommendation systems, robotics, games**
- **alpha go/alpha zero: cnn + game + rl**
- **alpha star: lstm + game + rl**
- **alpha fold: data + modeling + cnn<sup>3</sup> + rl**

# recap

- **machine learning isn't magic, just math**
- **data + model + computer —> predictions**
- **field is advancing rapidly, future is bright!**
- **fast.ai course + online gpu**