



SCHELLER TEACHER EDUCATION PROGRAM
education arcade

Artificial Neural Network

Building Activity / Game



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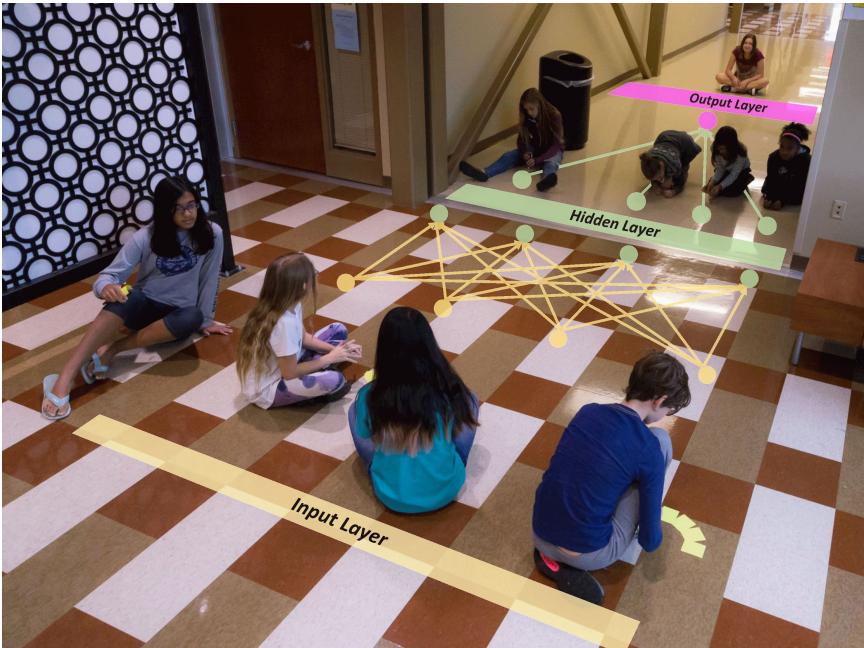
Outline

- Quick introduction - our motivation
- Play test a Neural Network building game
- Discussion
 - What did you learn about Neural Networks?
 - Analogies and (mis)conceptions
 - How to improve this activity?

Introduction

- Neural networks are one kind of Artificial intelligence tool that is impacting many parts of our world.
 - ex) how do self-driving cars identify what they “see”
- Can a hands-on activity help people understand how artificial neural networks work?
 - Assess what are they might be good at, bad at?
 - Attach names to processes?
 - Predict how might make errors?

Let's play!

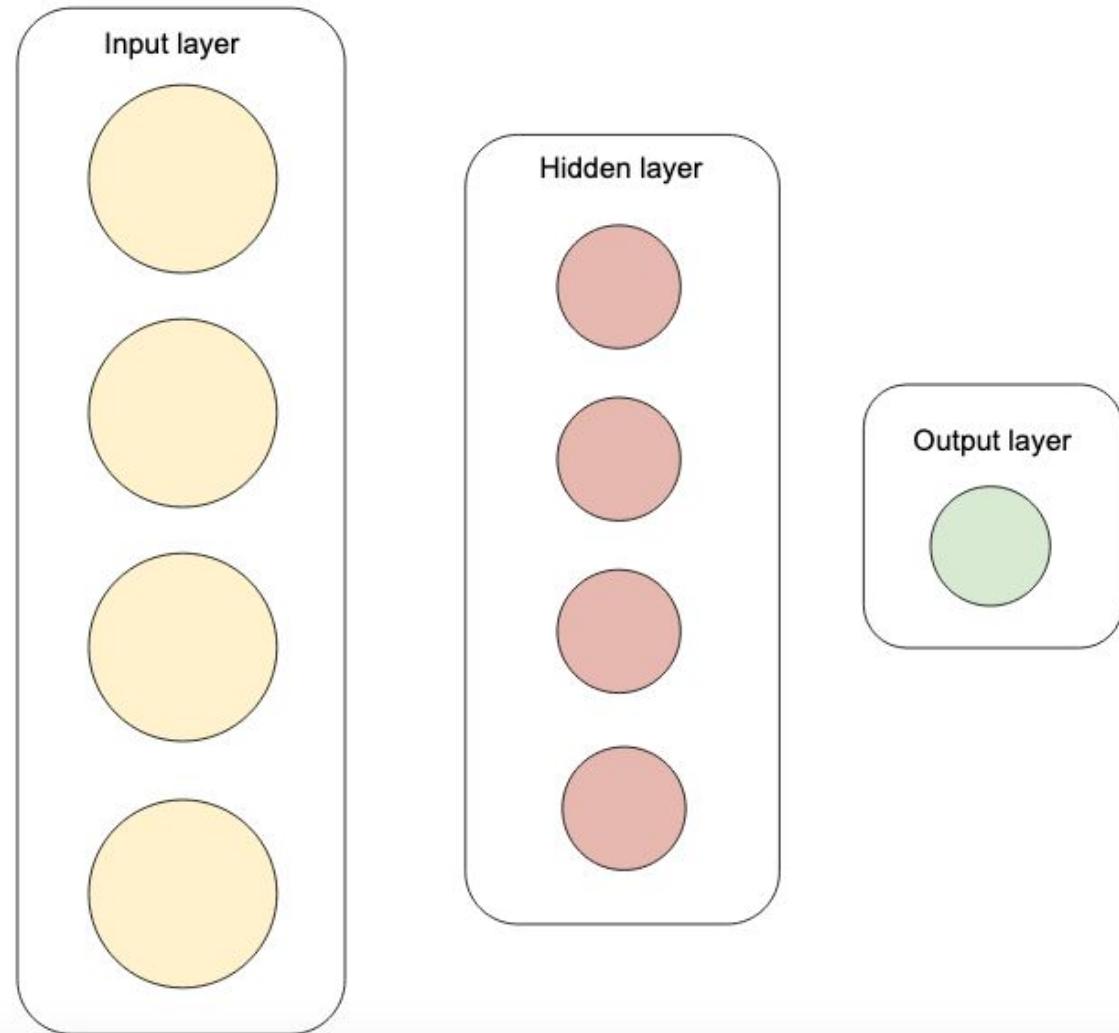


- We are going to act out a neural network
- This activity is a modification of an activity designed for TechGirlz.
- It's like a version of the game "telephone"

https://docs.google.com/document/d/1_uGzFd-iHBgCui1NMSwtcQJbrlCKpiXZGp55fZv3Ilk/edit#

Let's play!

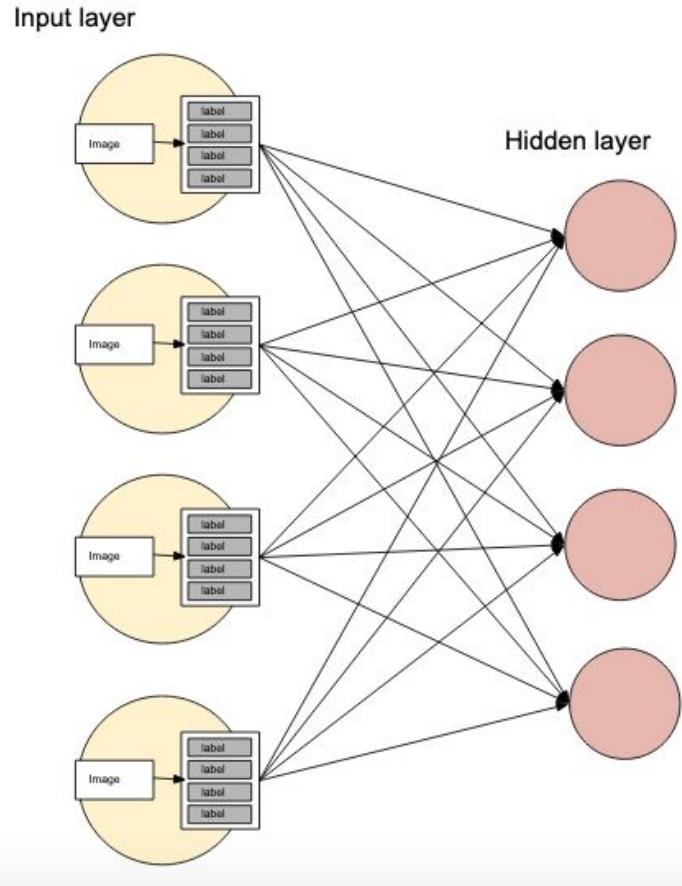
- Our network has 9 players arranged in three layers
- There is an input, a hidden and an output layer.



Game play:

Players in the Input layer
(in yellow) will:

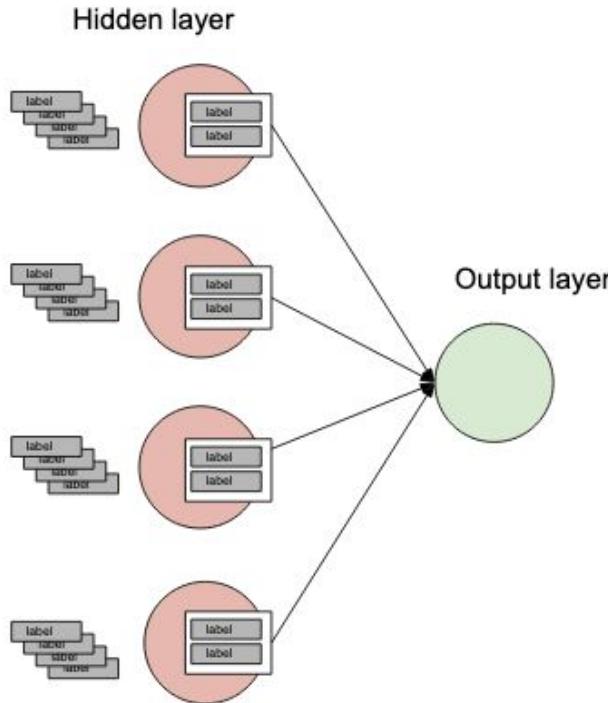
- receive an image
- write down 1 word on each card (4 cards per node).
- send 1 card to each of the 4 players in the hidden layer (pink).



Game play:

Players in the Hidden layer (in pink) will:

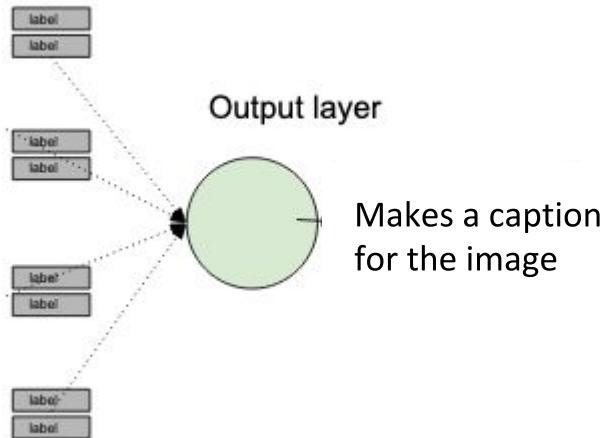
- receive 4 different words, one from each input node,
- Select and write down 2 words on their pink card.
- send their card to the player in the output layer (green).



Game play:

Output node (in green) will:

- receive 8 different words
- Picks 4 words to make a caption for an image.
- Can add a filler word like “in”, “on”, “for”, or “with”



End of round: (the reveal)

Everyone gets to see the image and the original and predicted captions.



original caption: help me hold tower

predicted caption: hold me leaning tower

End of round (part 1):

Scoring:

- Did the captions match?
- How would you assign a score the guessed caption?



original caption: help me hold tower

predicted caption: hold me leaning tower

Image & caption



original caption:

predicted caption:

Image & caption



original caption:

predicted caption:

Image & caption



original caption:

predicted caption:

Image & caption



original caption:

predicted caption:

Image & caption



original caption:

predicted caption:

Image & caption



original caption:

predicted caption:

Image & caption



original caption:

predicted caption:

Image & caption



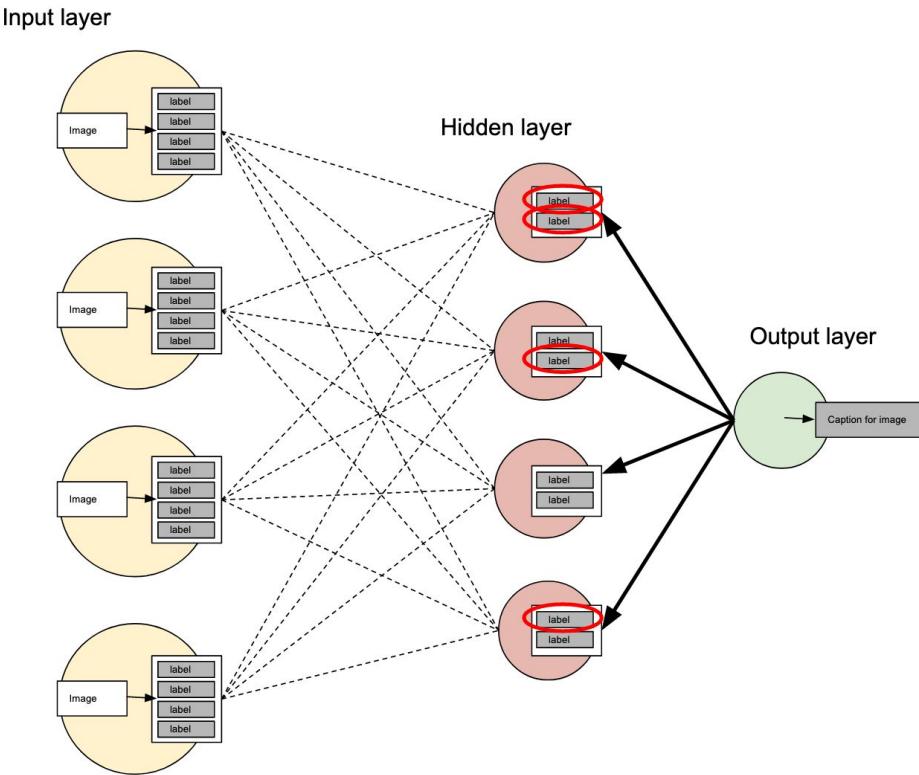
original caption:

predicted caption:

End of round: (part 2)

Starting with the output node:

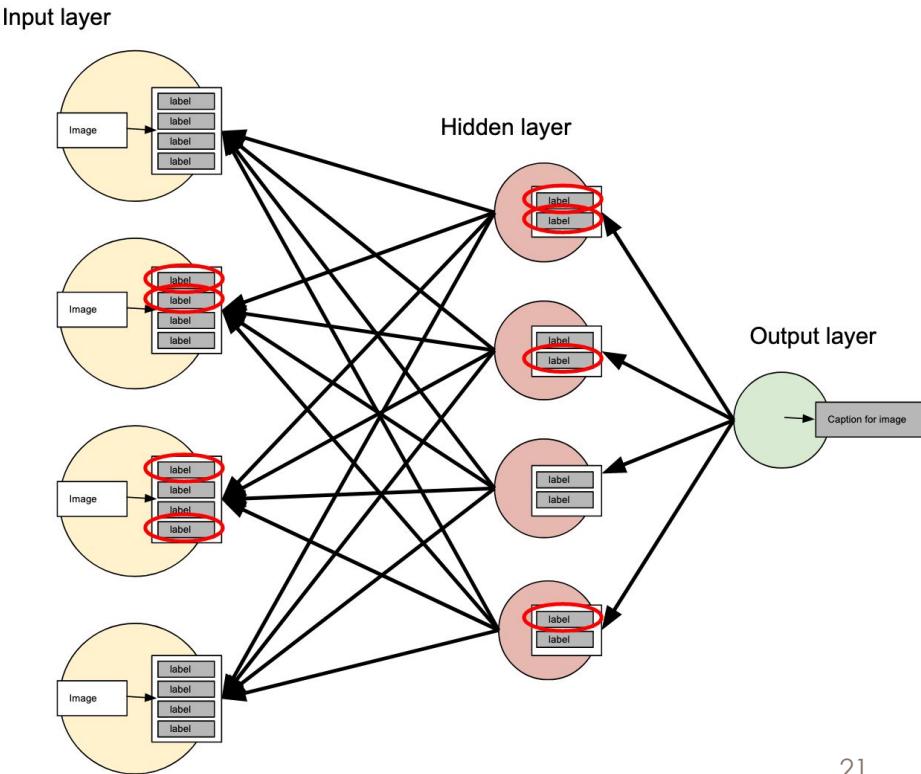
- Circle the words on your card(s) that were in the original caption.
- Return cards to the sender.
- Hidden layer does the same



End of round: (part 2)

Hidden layer does the same:

- Circle the words on your card(s) that were in the original caption.
- Return cards to the sender.



End of round: (part 3)

Input and Hidden nodes:

- What could you do to give the node in the output layer (green) a better chance of matching the caption? ?
- How will you adjust your strategy? ?

How'd the network do?

- Did the output node compose the correct caption?
- How did players decided what words to write, or pick and pass on?
- What would you as a node do differently now that you've seen an example of a caption and the scoring?
-

Next, play another round

- Discuss how your decisions change in each round.

What does this have to do with ML?

- We modeled / simulated training an artificial neural network!
- Did it get better (learn) in the second round?
- What might be the impact of adding more nodes or more layers?
- How could such a system be good with one kind of photo but bad with another?

Review

Each player was a “node” in a neural network

We may have seen something like “learning” - how a neural network learned to send words that would lead to a greater possibility of composing the correct caption.

Terms and Analogies

“Feed Forward”

“Loss function”

“Back propagation”

“Weighting”

“Gradient descent”

“better”

next time)

Terms and Analogies

- “Feed Forward” (passing information to the next node)
- “Loss function” (scores over time on the prediction)
- “Back propagation” (sending circled words back to nodes)
- “Weighting” (assigning more “value” to words from certain nodes who gave “good” words in the past)
- “Gradient descent” (adjusting one’s strategy to do “better”
next time)

How this activity was different from ML

- You are smarter than actual neurons.
- You “make sense” of the images and words you received
- Neural networks have no knowledge of the world, they don’t make meaning of the input.
- NN may start with random words and tune the network from there.
- Training may take 1000s of repetitions of process that you just simulated.

**Give us feedback:
how would you improve this activity?**

THANK YOU for playing with us!