THE GAME OF SET

an exploration of computer vision and neural nets

By Molly Baird

Overview

- The Game of Set
- Computer Vision
- The Problem
- The Data Collection
- Neural Net
- Results
- Extensions

1.

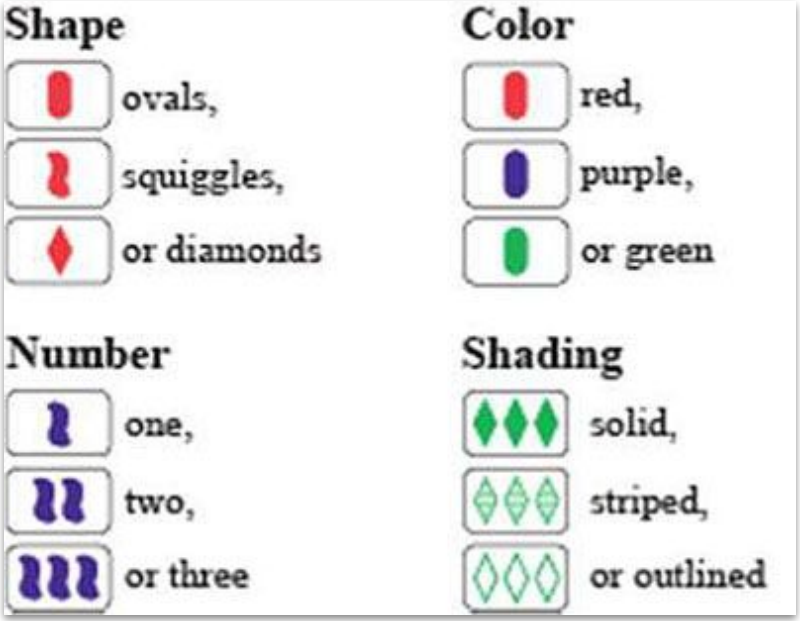
THE GAME OF SET

History

- Designed by Marsha Falco in 1974
- Look for patterns between shapes on playing cards

How to Play the Game

- Lay out 12 cards
- Each card has 4 attributes
- Find a “SET”:
  - 3 cards
  - For each attribute:
    - All the same, or
    - All different



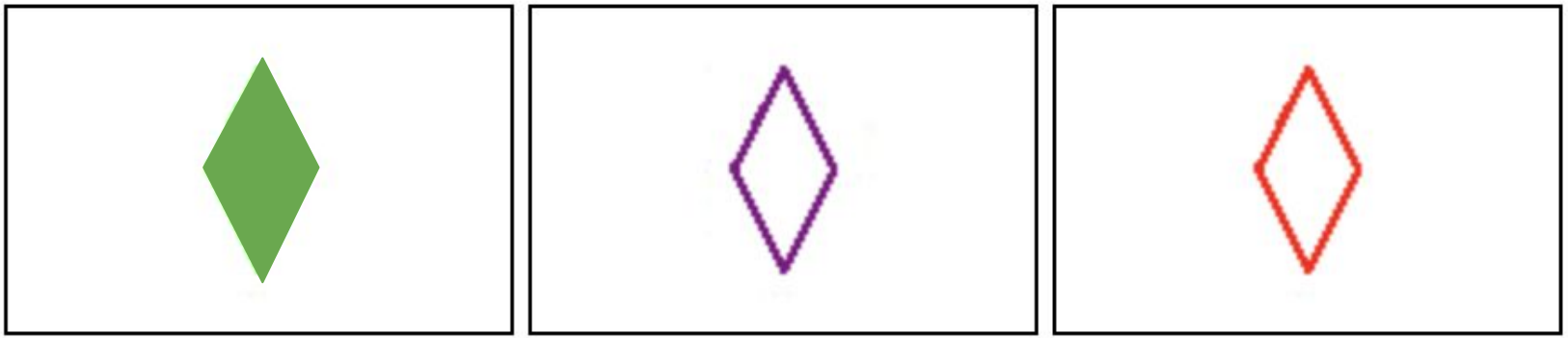
A “SET”

- Color: All Same
- Shape: All Same
- Number: All Same
- Fill: All Different

Also A “SET”

- Color: All Different
- Shape: All Different
- Number: All Different
- Fill: All Different

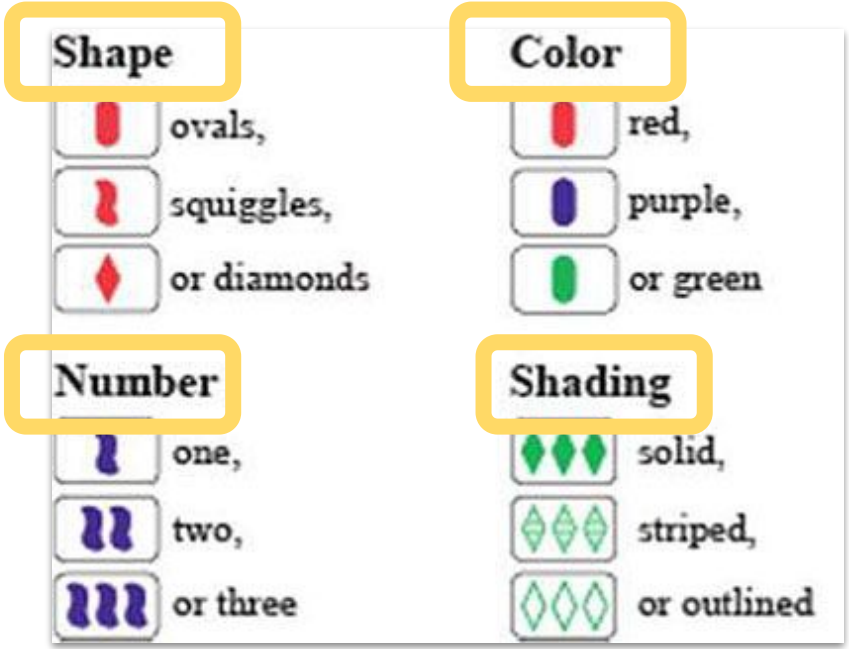
NOT A “SET”



- Color: All Different
- Shape: All Same
- Number: All Same
- Fill: **TWO SAME**

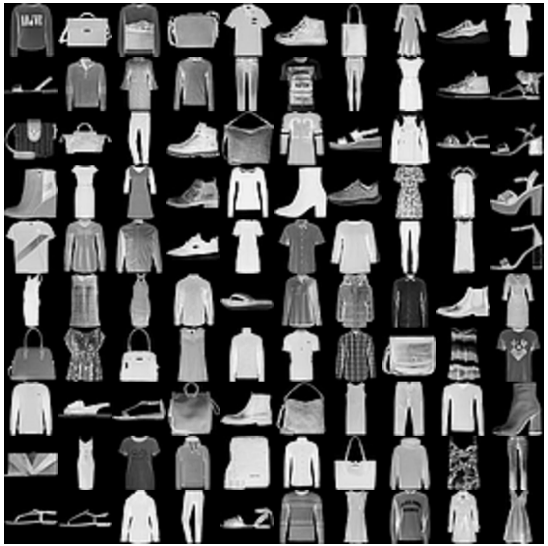
How to Play the Game

- Lay out 12 cards
- Each card has 4 attributes
- Find a “SET”:
  - 3 cards
  - For each attribute:
    - All the same, or
    - All different



2.
COMPUTER VISION

Image Classification



Fashion MNIST Dataset

Examples

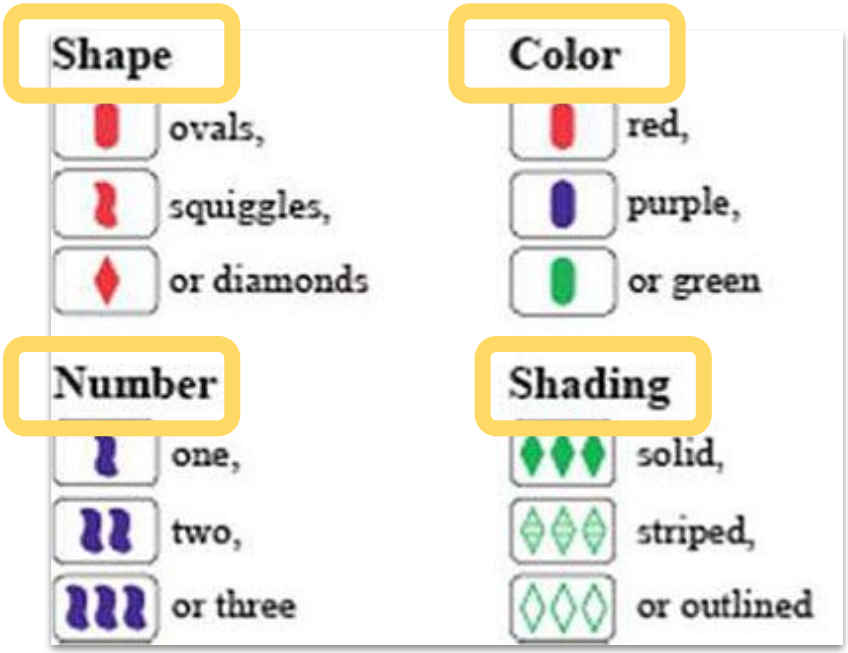
- Reading handwriting
- Labeling an x-ray
- Taxonomy
- Crop yield
- Face recognition
- Weed detection
- More!

How do we classify images

- Look for properties...

How do we classify images

- Look for properties…
  - Shapes
  - Colors
  - Numbers
  - Shading



3.
THE PROBLEM

Problem Statement

Can I train a computer to detect a set, and in doing so draw insights about similar computer vision problems?

4.
THE DATA COLLECTION

Data cleaning and exploratory data analysis will be about 90% of your life from now on

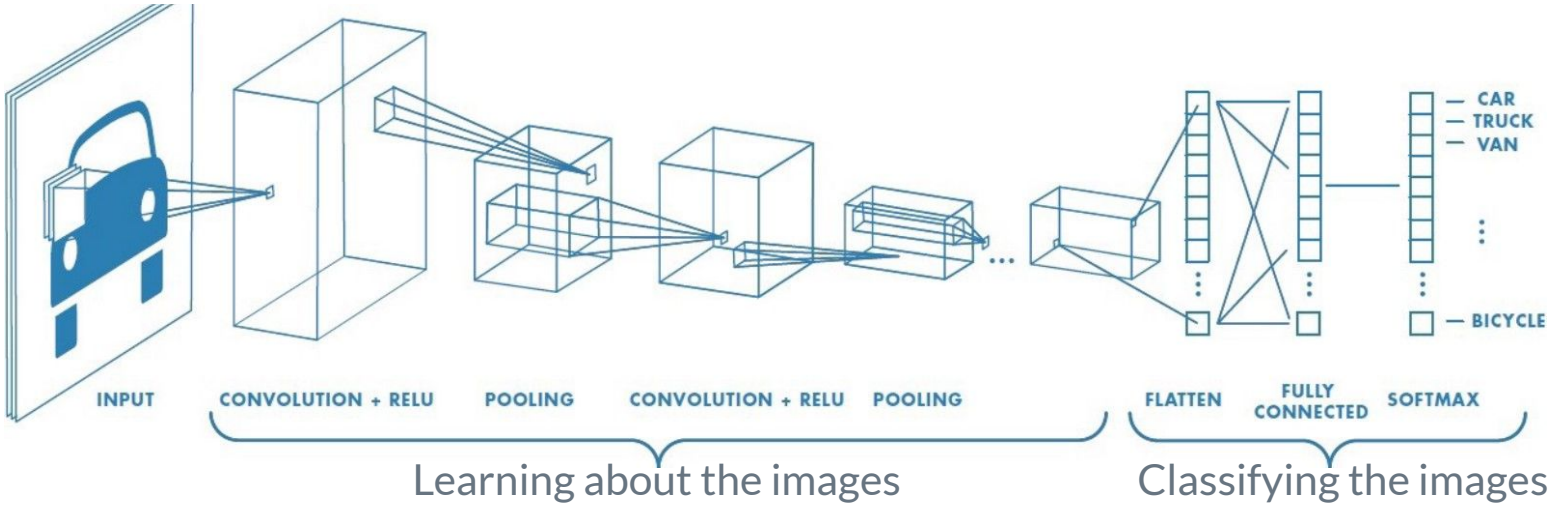
- *every GA DSI Instructor ever*

Collecting Data

- Scanned in 81 cards
- Labeled them
- Generated every possible set
  - 85,320 possible sets
- Labeled whether or not a set was a “SET”
  - 1,080 “SET”s
- Randomly sampled 1,080 “NOT SET”s
- Combined to create main dataset of **2,160** Sets

5.
NEURAL NET

Convolutional Neural Net



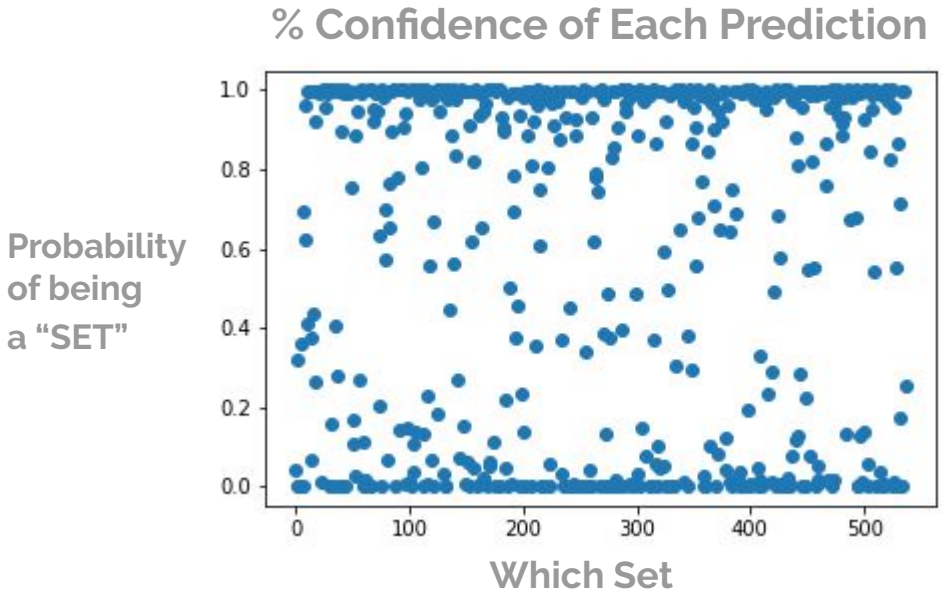
- Input: 3 cards glued together
- Output: 0 = " NOT SET", 1 = "SET"

6.
RESULTS

75% accuracy

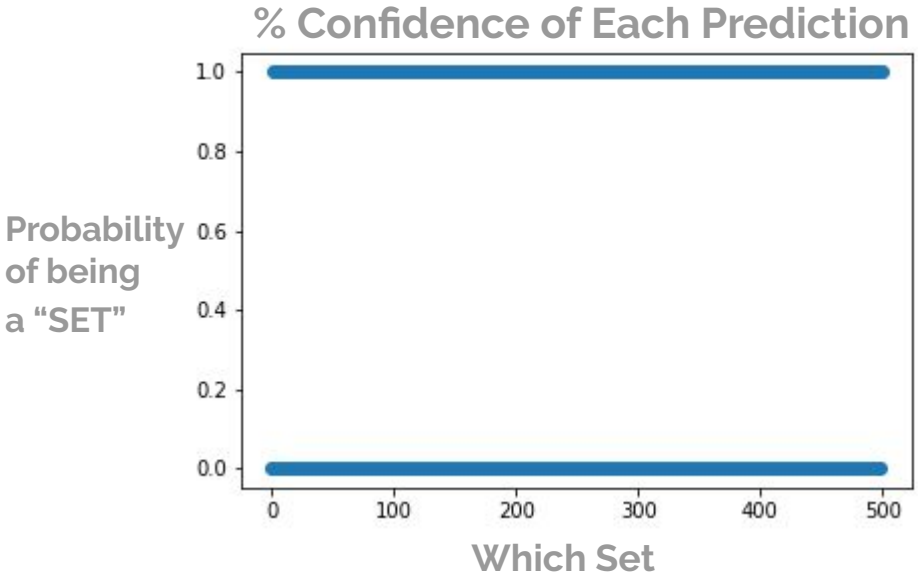
...alright, I'll take it

How sure what the neural net?



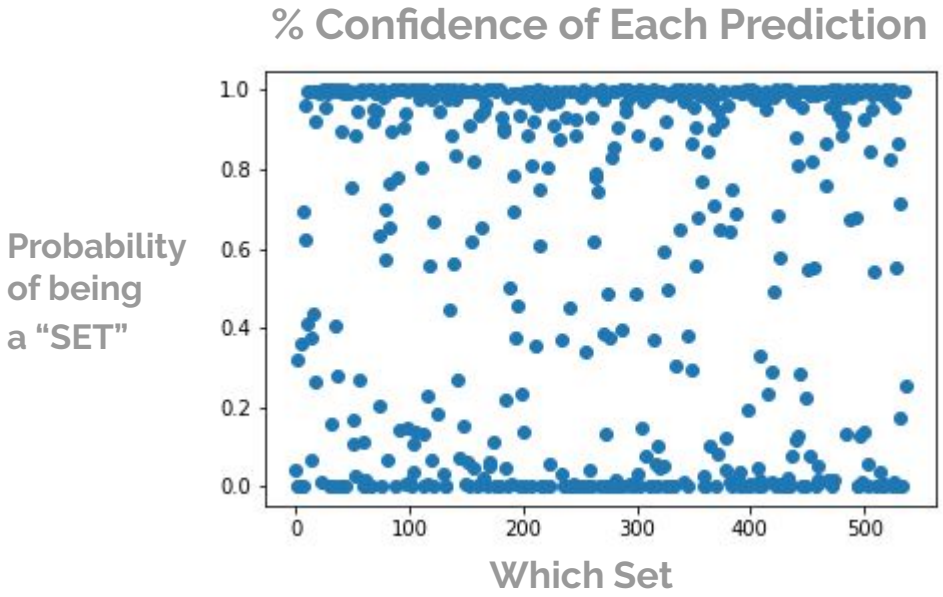
- It seems decently sure of itself

How sure what the neural net?



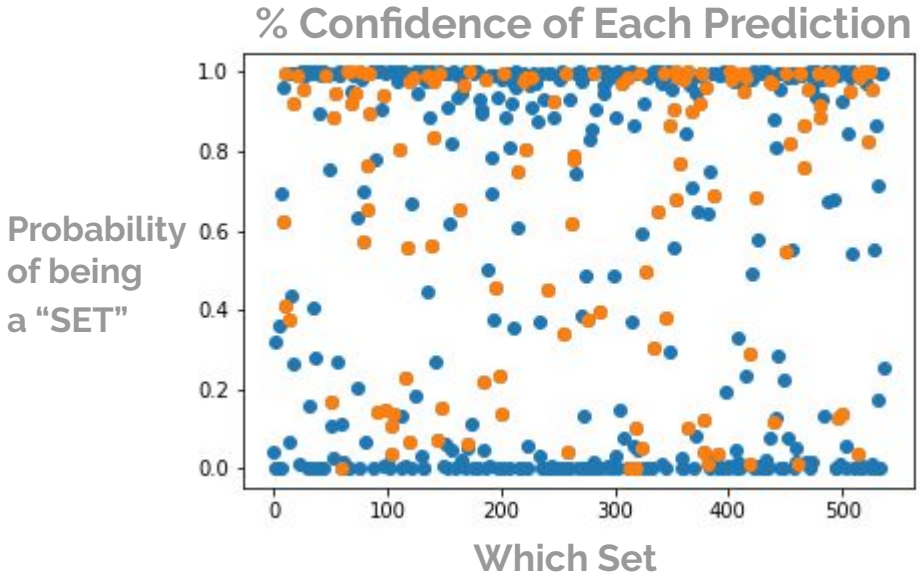
- If it were 100% certain of its choices, all points would be at 0 or 1

How sure what the neural net?



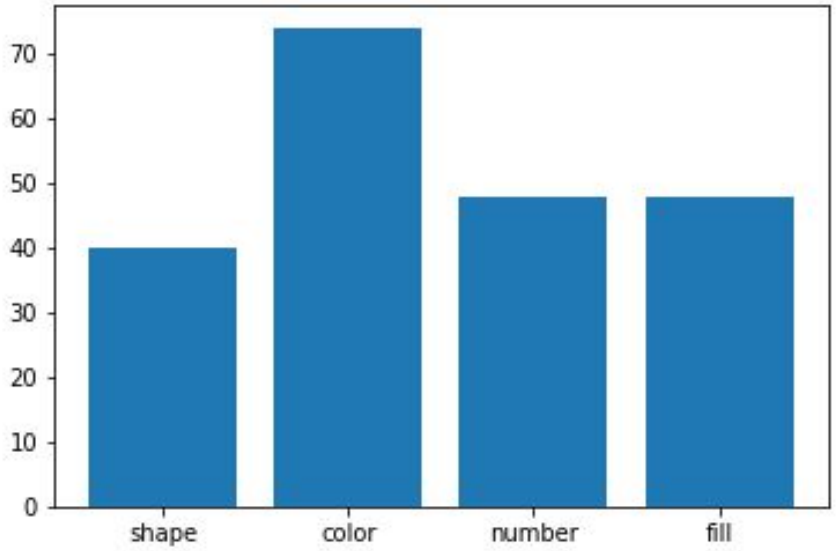
- It seems decently sure of itself

How sure what the neural net?



- Wrong predictions in orange
- Wrong predictions tended to favor "SET" rather than "NOT SET"

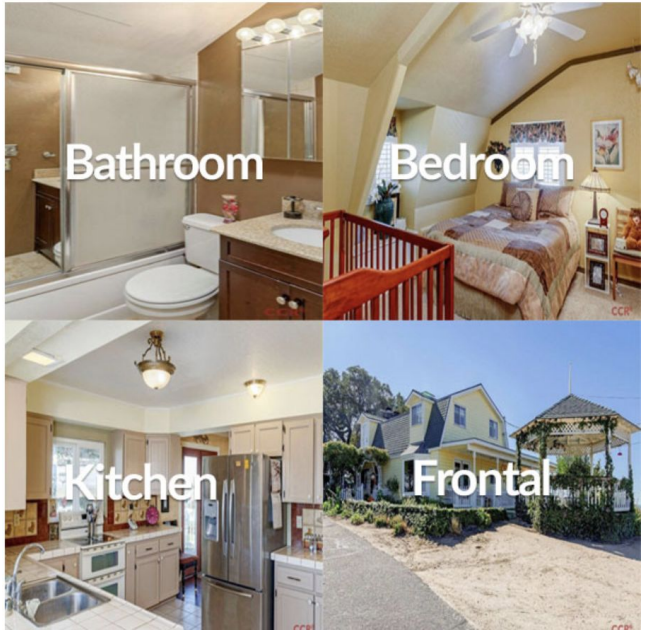
Performance by attribute



- Is it a “SET” in the sense of each attribute and did it predict “SET”?
- Best at color
- Worst at shape

6.
EXTENSIONS

Multi-Image Classification



Examples

- Predicting house price
- Are these animals/plants the same species?
- Are these people related?
- Are these plants weeds?
- More!

Thank You!

Follow up questions?

linkedin.com/mollycbaird
mollycbaird@gmail.com