All About That Money!

Payden Beyer, Graham Fuller, Jacob Oakes, and Sydney Satchwill

Problem:

Given an image containing money, find and classify the bills and coins in the image.

Applications

Applications to the Class

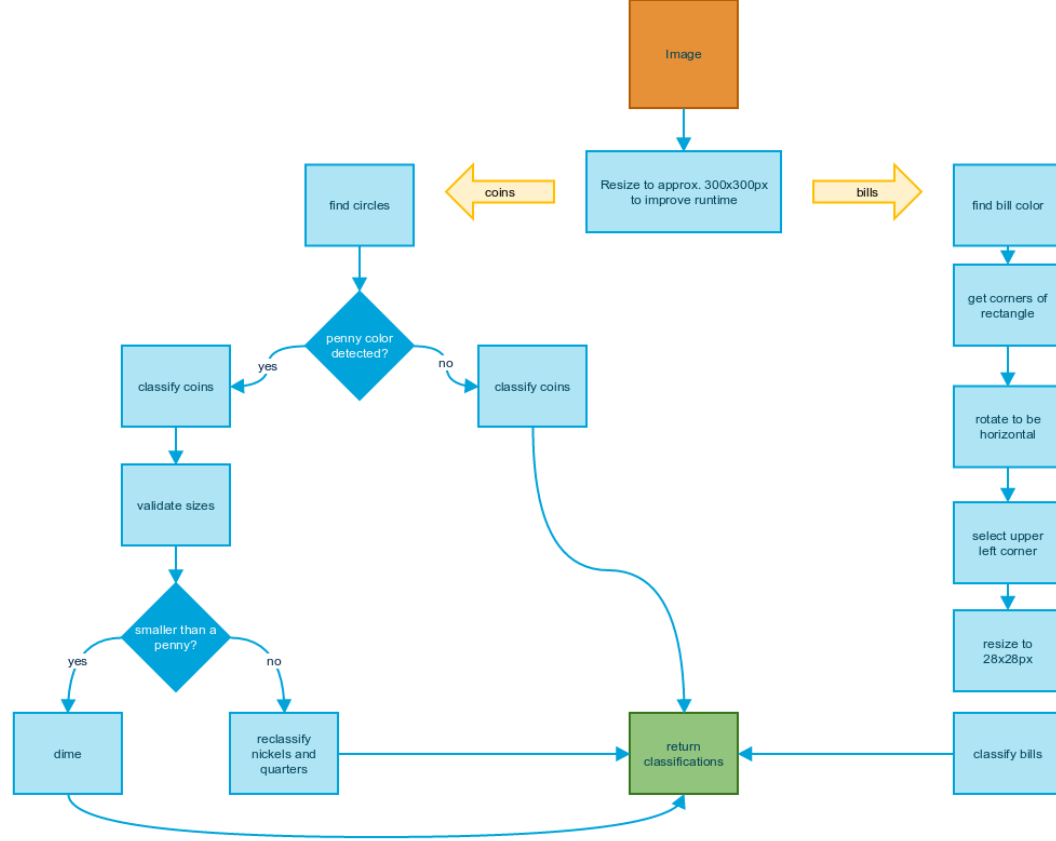Hough transforms
Hue thresholding
CNNs and NNs
Edges

Goals

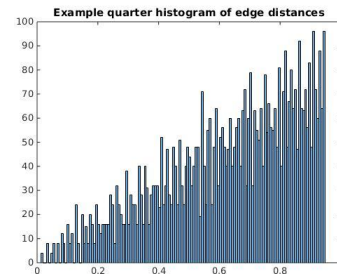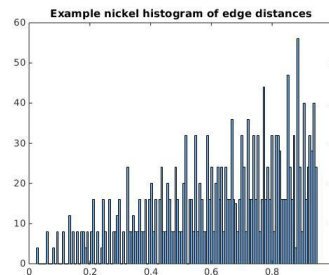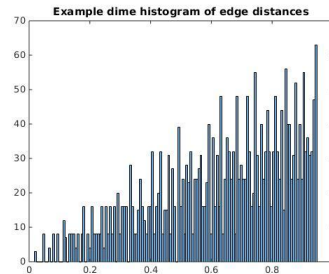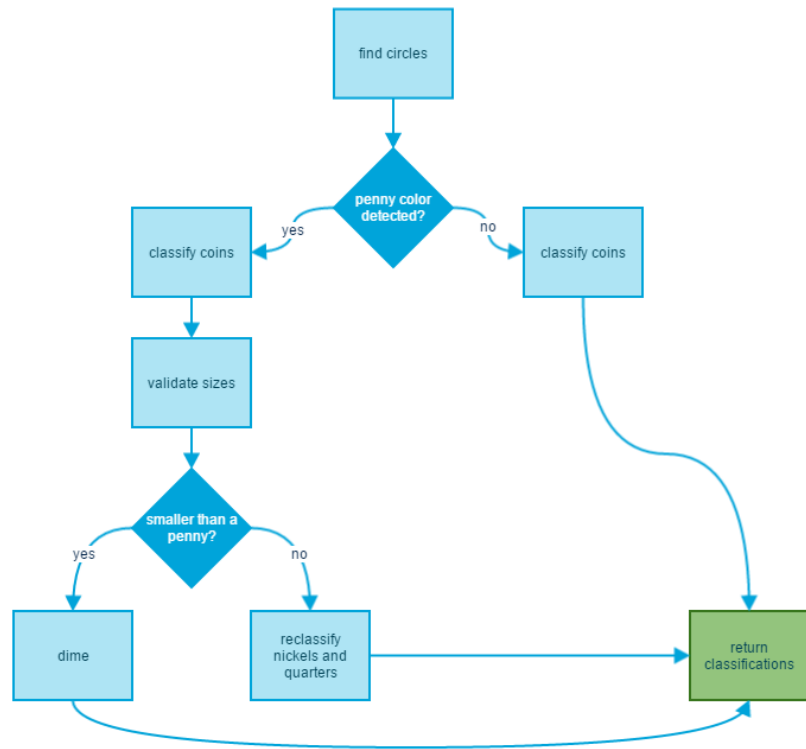Minimal - Identify individual coins and bills

Reasonable - Identify coins and bills in the same photo, non-overlapping

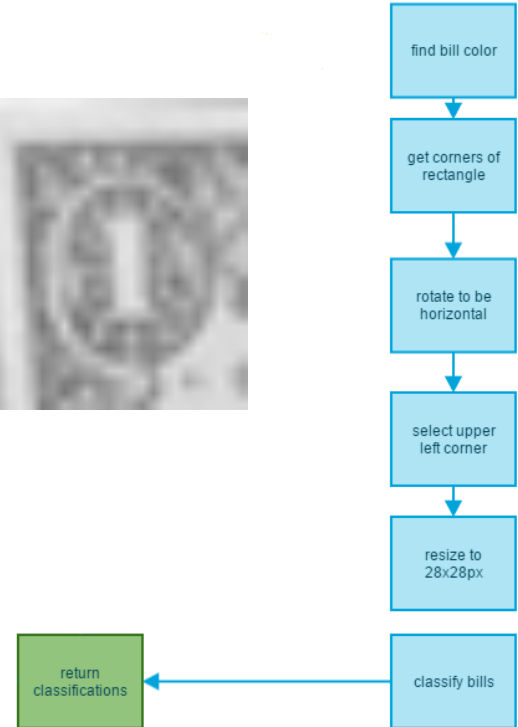Stretch - Identify coins and bills, overlapping, at different angles

Classification Flow

Coins

Coins

Strengths - Really good at finding circles, perhaps too good, fairly good accuracy

Improvements - Very slow, poor performance in warm lighting

Bills

Bills

Strengths - Feature is unique to each bill, computationally simple to perform, good accuracy for straightforwardness of algorithm
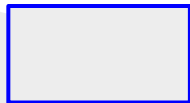
Improvements - Select bill areas using perpendicular lines rather than hue, transform non-overhead images
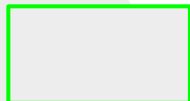
	$1		penny
	$2		nickel
	$5		dime
	$10		quarter
	$20		
	$50		
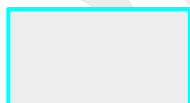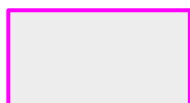
Live Demo

pictures/demo/1.jpg

pictures/demo/3.jpg

pictures/demo/2.jpg

pictures/demo/penny.JPG

pictures/demo/penniesbacks.jpg

pictures/demo/dimesback3.JPG

pictures/demo/10.jpg

pictures/demo/72.jpg

pictures/demo/3.png

pictures/demo/nickel1.JPG
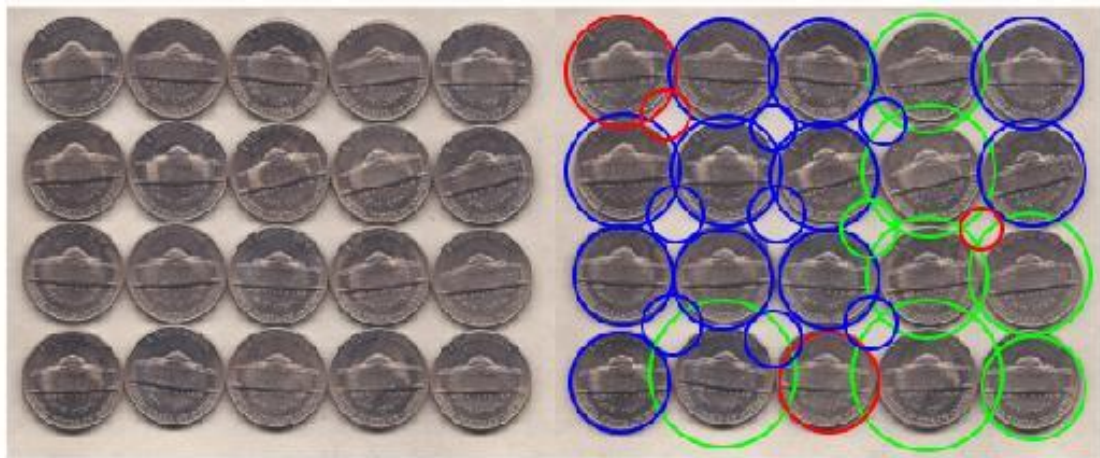
Testing Sets for Accuracies

Coins

188 test images

- 21 pennies
- 44 nickels
- 39 dimes
- 84 quarters

Bills

35 test images

- 4 ones
- 4 fives
- 7 tens
- 6 twenties
- 6 fifties

Results

Quarter/Nickel/Dime ACC = 85.03%

- CNN 75.78%
- NN that has histogram features 77.84%
- NN that has edge mask features 61.8%

Nickel/Quarter NN that takes histogram features

ACC = 94.53%

Bills CNN ACC = 75.00%

Lessons Learned

- CNN > Neural Net
- Finding rectangles is hard, and using color is terrible
- 3 classifiers are better than one

Fun Facts!

How many pennies are produced each day? About 30 million. That's 1040 pennies every second!

In 2007, 38 million bills were produced a day with at total value of $750 million.

How much does it cost to make a bill? It cost around 6.2 cents to produce a bill in 2007 considering that 9.1 billion notes were made

100 million one-cent coins weights 246 tons. They may seem weighty – but they're worth 1 million dollars when cashed in. That's 20,000 coin rolls!

The world's largest coins were used in Alaska in 1950. At 3 feet in diameter, these 2 feet wide coins weighed 90 lbs each! Having to create jumbo sized wallets may seem like a pain, but the high value of the coins made it all worth while. Each coin was valued at $2,500.

Ewwww... 13% of coins and 42% of bills test positive for unpleasant bacteria, such as fecal bacteria

How long do bills last? A US $1 bill or a $10 bill last for an average of eighteen months. Five dollar bills last around fifteen months, and twenties kick around for two years. The larger denomination bills can last up to eight years!

Good thing that the average coin lasts for 25 years, [17] since new pennies cost over 1.67 cents each to make.

3 in every 10,000 US bills is counterfeit.

References

http://www.happyworker.com/magazine/facts/weird-and-wonderful-money-facts#.VONJmyvF-4v