Pharmaceutical Pill Recognition Using Computer Vision Techniques

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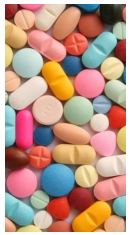
Introduction

What if you could take a photo of an unknown pill and almost immediately find out what it is?

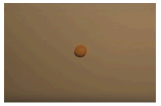
- Unidentified and misidentified prescription pills present challenges for patients and professionals. Taking such pills can result in adverse drug reactions that affect health or could even cause death. By coming up with ways to easily identify and verify prescription pills, errors can be greatly reduced.
- Our goal is to produce a framework or set of methods that will take a consumer-quality image of a pill (taken from mobile phones), and help to identify it by returning the most likely matches from our database set of pill images.



Dataset

The National Library of Medicine has made public a set of pill images that include:

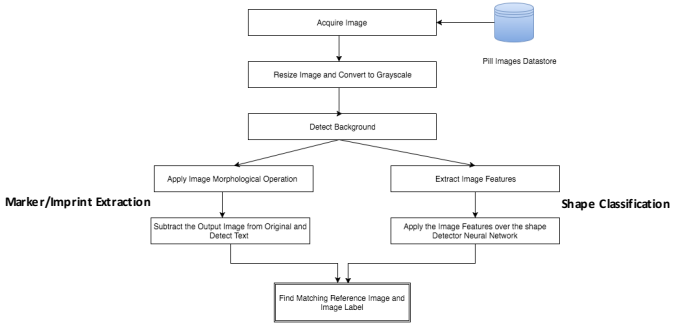
- 2000 JPEG high-resolution **reference** images (one for the front and one for the back of each of 1000 pills) from the Computational Photography for Pill Identification Project.
- 5000 JPEG **consumer quality** images of the same 1000 pills, taken with digital cameras in varying light conditions

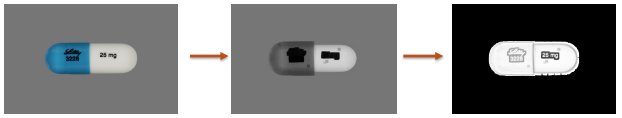
Two examples of consumer-quality pill images


The corresponding reference image matches for the two pills shown on the left

Overview of Process



Marker/Imprint Extraction



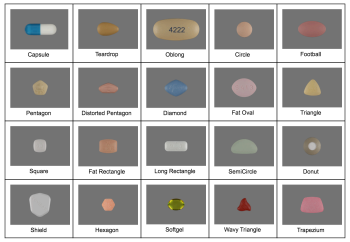
Original Image — Image after applying erosion technique — Output after subtracting erosion output image from original image

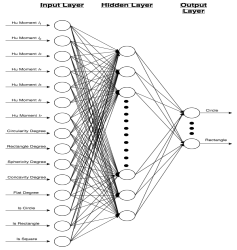
- The most distinguishing factor for pill identification is the markings or imprints on the tablets or capsules. To extract these features, we used a few morphological image processing operations to enhance the imprints.
- Following that, we used open-sourced **Object Character Recognition** software to try to extract the numbers and words imprinted.
- **Scale-Invariant Feature Transform (SIFT) descriptors** of each pill were also extracted to try to capture a representation of the image.

→ " 3228 25mg "

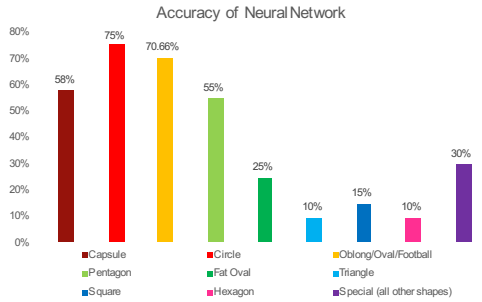
Shape Determination

- Each image is converted to greyscale and background is subtracted to get an idea of overall shape.
- Twelve shape features are also extracted for each image, including: t**he 7 Hu invariant moments, circularity degree, rectangle degree, sphericity degree, concavity degree and flat degree.**
- We categorized and labeled each pill in our training dataset by shape and trained a neural network on these images and features

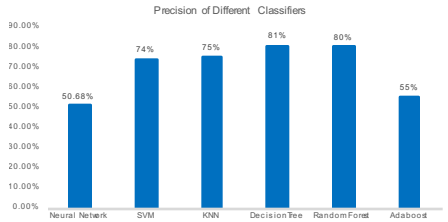




Results of Shape Determination



- When given the consumer quality images, the neural network gives an overall of **50.7%** accuracy.



Challenges and Future Work

- Limited amount of data - only a few images for each specific pill. Need to gather more images from other resources.
- Lack of diversity in shape (mostly circle or oblong)
- Imprints challenging and requires more research.
- Color hard to match due to differing light conditions and camera lenses.
- Create wrapper to classify and suggest best matches.

References and Acknowledgements

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Acknowledgements