Pill Detector

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Overview

The pill detector is an application where you can take a picture of an unknown pill and get the name of this pill and its medical description based on the color and shape of the pill.

This application is valuable for blind people who need to identify their medication before taking it or while arranging them as it supports the Text to Speech feature.

It can also be used in other domains and can be developed to widen the scope of its users.

All medications are from local (Egyptian) pharmacies.

We do similar tasks to the ones made here:

- https://www.webmd.com/pill-identification/default.htm
- https://www.rxlist.com/pill-identification-tool/article.htm

Team Members

- **Yomna Jehad Mohamed**
- **Youmna Mahmoud Hussein**
- **Ahmed Amr Ebeid**
- **Mohamed Mohamed Morsy**

TEAM MEMBERS ROLES:

All the team members will participate in implementing the algorithm and the mobile application.

Although some members are going to lead in certain aspects, perfect circulation is to be guaranteed.

Project's Implementation

for this prototype, an image of the pill with a monocolored background is taken from the mobile application and then the processing starts.

1. **Noise Elimination**
    - First, we apply a Gaussian filter for smoothing effect on the image, this enables removing the background noise and reduces the possibility of detecting wrong contours.
    - Then we apply a sharpening filter on the smoothed image to increase the accuracy of the contour detection.
2. **Shape detection**
    Detect the shape and color in python.
    - First, we extract the edges in the image using a canny edge detection algorithm, then find the contours.
    - We then sort the contours according to their areas descendingly and assume that the contour with the biggest area is the contour of the biggest edge which is the pill's contour.
    - Finally, we approximate this detected contour to a known shape: either Ellipse, Hexagon, Pentagon, Square, Rectangle or Circle based on trial and error obtained thresholds.

3. Color Detection

- We crop the image into a rectangular image that bounds the detected drug.
- We then zoom into the center of the cropped image to obtain a new image which only contains different shades of the drug's color.
- We calculate the average of these shades and we assume that this is the drug's color.
- We increase its color saturation by converting it to the HSV Color Space and multiply the S channel with a value obtained through trial and error then it is converted back to BGR Color Space. This enables us to detect white and black colors accurately and differentiate between them and light or dark shades of other colors. We send this value to a KNN Classifier with white/black/other labels and RGB values.
- We convert the original color to HSV Color Space and send it to KNN Classifier but this time with HSV values and labels of different colors. HSV Color Space has the advantages of maintaining the color value in different lighting conditions.

Other Components

1. **Database**
    - Our database is a JSON file contains each drug's name, shape, color, and description.
2. **Server Side (Django Python)**
    - We call the functions that return the shape and the color of the drug in the backend python script and use the output to access the database and return the drug's name and description.
    - We uploaded the script on an online server to make it easier for the application to process the output.
    - In the backend script pipeline, we first receive the image from the mobile application in a base64 form. Then we decode the image form a base64 to a normal cv2 image to then apply the processing pipeline on. In the end, we return the name and the description (if found) to the mobile application.
3. **Mobile Application**
    - The mobile application launches to a screen with one button: capture an image, after capturing it, another screen shows up with the captured image and two buttons: Pill-Check and Re-Capture.
    - If Re-Capture is pressed the application is directed back to the capturing mode.
    - If Pill-Check is pressed the application converts the image to base64 and sends it to the online server in which the processing occurs. And then waits to receive the output.
    - The output can be either printed on the screen or heard through Text To Speech Feature.
    - If the application fails to detect the drug it will return UNDEFINED.

Prototype test cases

We tried the application on 8 different drugs with different shapes and colors.

- Cataflam

- Panadol

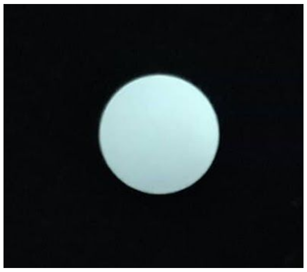
- Brufen

- Ketofan

- Paracetamol

- Comtrex

- Alphintern



- Milga

Development Process Obstacles

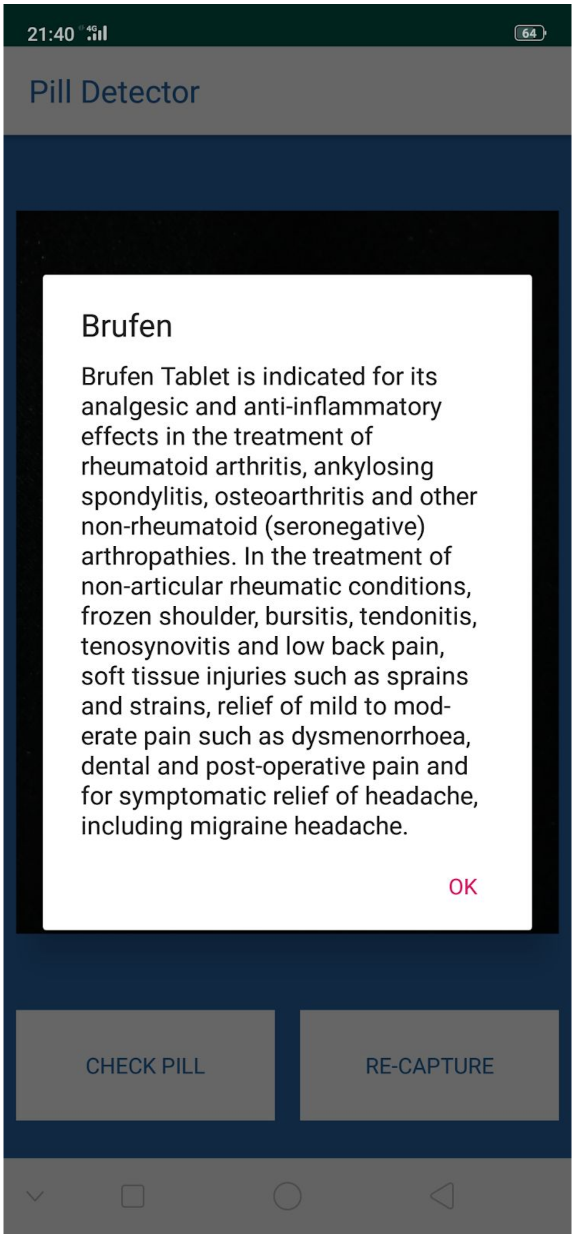
- Besides the obvious obstacles in the previously described algorithm, we also tried out different approaches to reach the best possible output.
- Regarding the Color Detection step, in the beginning, we thought thresholding in RGB values would be enough, but after further testing, we realized the best result would come if we use a classifier so we used a simple Knn classifier. First to distinguish between White, black and other colors because it would usually assume that very light or dark shades of other colors are either black or white, so we would increase the saturation and determine whether it’s white, black or other. And for that purpose, we tuned our own training set.
- After that, we start distinguishing between other colors in HSV color space to avoid lighting conditions effects. And again we tuned out own training set, However, the results sometimes seemed off, and we started to question whether this set is accurate enough or not, so we plotted the training set in 3D graphs and started omitting the out layer and unreasonable values. And even though the HSV values were not linearly separable it sort of helped to understand the training set.

Application Usage

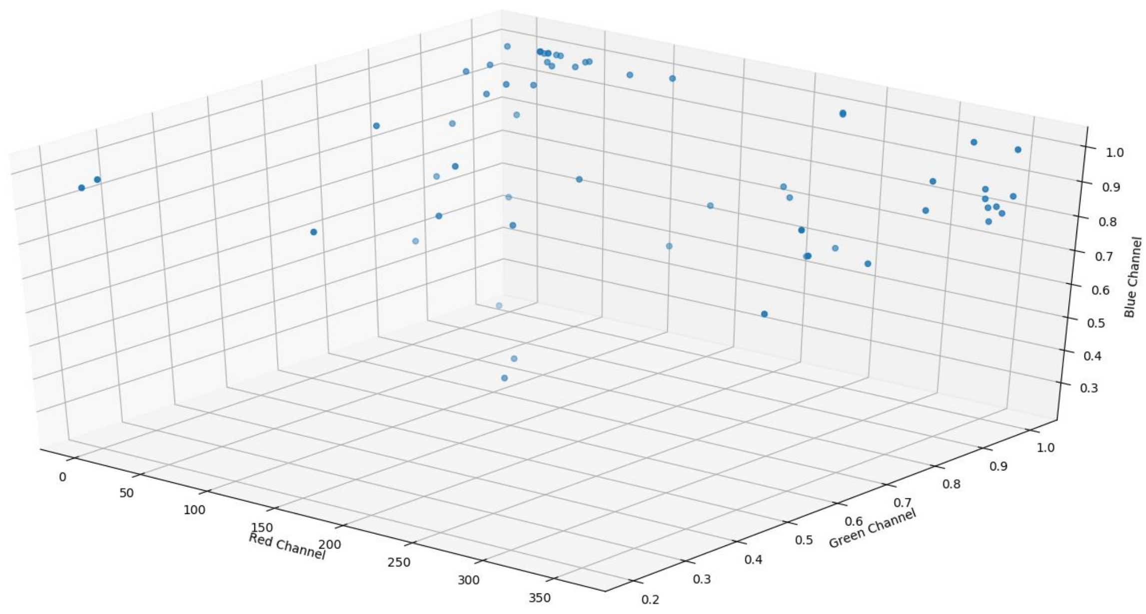
Open the application

Capture a pill

Get results


21:40
64
Pill Detector
Brufen
Brufen Tablet is indicated for its analgesic and anti-inflammatory effects in the treatment of rheumatoid arthritis, ankylosing spondylitis, osteoarthritis and other non-rheumatoid (seronegative) arthropathies. In the treatment of non-articular rheumatic conditions, frozen shoulder, bursitis, tendonitis, tenosynovitis and low back pain, soft tissue injuries such as sprains and strains, relief of mild to moderate pain such as dysmenorrhoea, dental and post-operative pain and for symptomatic relief of headache, including migraine headache.
OK
CHECK PILL
RE-CAPTURE

Internal analysis of different images' colors in the RGB



Project future plans

- Add more drugs and medications to the database, in addition to more details about them like instructions and warnings.
- Enable the user to add a drug to the database if it doesn't already exist. This should happen by asking the user to capture multiple images of the drug and input the name of it, afterward, the algorithm would detect the average shape and color of the drug and attach it to its name in the database.
- Add scheduling feature to notify the user with their medications time and warnings.
- Modify the Knn training set to contain more color shades.
- Enable a multiple drug detection Mode in addition to the already existing single drug detection mode. So that the user (not blind) would be able to quickly find out which drug is which from a single shot.