# Independent Project Report

# Bye Burns

**Guide: Dr. Puneet Goyal**


**Submitted** By:

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# Table of Contents

## Abstract

A number of deaths happen every year due to negligence in burn cases. These are due to lack of first-aid knowledge, inability to reach the doctor in time and get proper medical attention. To avoid such situations we are trying to work on an App which serves as an Educative-cum-First Aid-cum-Find Medical Help platform.

The Independent Project mainly involved 3 components, Database Collection, Android App Development and Machine Learning-Image Analysis components.

Tools used: Matlab, Android Studio

# Acknowledgement

We sincerely thank Dr. Puneet Goyal under whose direct guidance we could complete our Independent Project. We are grateful for his valuable guidance and encouragement in carrying out this project work efficiently.

We would like to thank the Director of Indraprastha Institute of Information Technology, Delhi – Dr. Pankaj Jalote, for providing us the opportunity to embark on this project. s

# Components

## 1. Database Collection

a. Link to Database

https://drive.google.com/open?id=0B11CcnfAGbdUWVU1SGFXWk5JZVE

b. Link to Database Description

https://drive.google.com/open?id=1phXTAghthXl2m-xUEh4JqiFCms2q_EHm2UcfR102bK8

As part of database collection, we tried to collaborate with the Burns Department of Safdarjung Hospital. We had several meetings with Dr. R. P. Narayan, a senior doctor at the hospital. For further collaboration, there needs to be a signing of MoU with Safdarjung along with the submission of a proposal to the Ethics Committee in the said format.

As the entire process was time consuming, so we took images of burns of various degrees from the Internet. The database now consists of around 50 pictures.

The database was processed, trained and tested on Matlab. After training the images, the classifier was tested by entering a test image and getting the predicted degree of burn.

# 2. App Development

## 2.1 Installation and Running Instructions

- Installing the App on any Android Phone
    - Download the apk from this link to the phone
    - Install the apk
    - In case the app is not being installed, Go to settings and allow installation of 3rd Party Apps
- Installing Android Studio for Modifying the code
    - Download Android Studio from http://developer.android.com/sdk/index.html?gclid=CLHUhd-kucwCFdOHaAod5t8HeA
    - Android Studio Docs http://developer.android.com/tools/studio/index.html
    - After Android Studio has been installed, open android studio and go to **File -> Open,** then navigate to the parent directory where you stored the downloaded project. Open

## 2.2 Features

- Our App Contains the following features
    - Panic Button -> Stores Emergency contacts that can be dialed on one click
    - Learning Module -> Consists of various educational modules which include:
        - Causes of Burns
        - Types of Burns
        - Domestic Burns
        - Statistics
        - FAQs
        - Prevention of Diwali Accidents
    - TBSA Calculator -> Calculates the Total Body Surface Area which is burnt
    - Maps -> Shows you the nearby hospitals depending on your current location and enables you to call them from there itself. It also shows the live traffic conditions.

- Diwali Checklist -> A checklist of common precautions one should take during Diwali Season

- Prediction for First-Aid -> The user can learn about the three degrees of burns, enter the tentative burn degree and get to know the first aid for it.

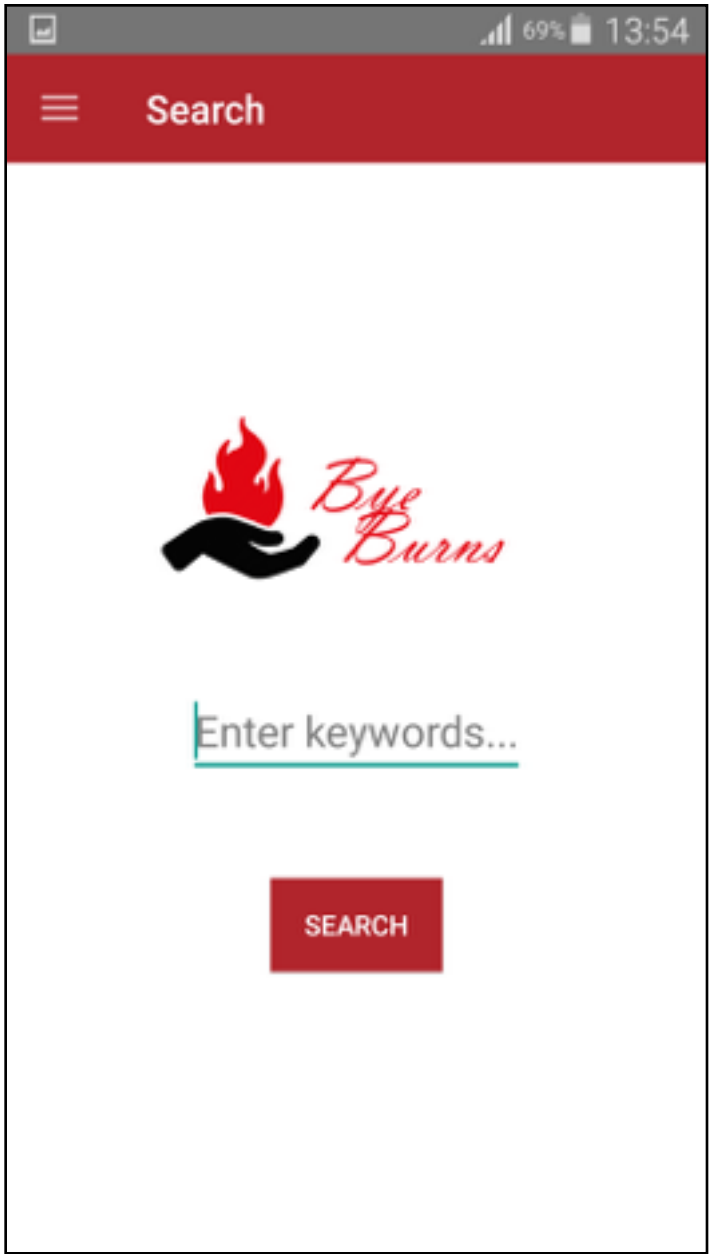
- My Story -> Burn victims can share their stories

- Recent Burn Incidents -> Directs you to the latest burn incidents around the world.

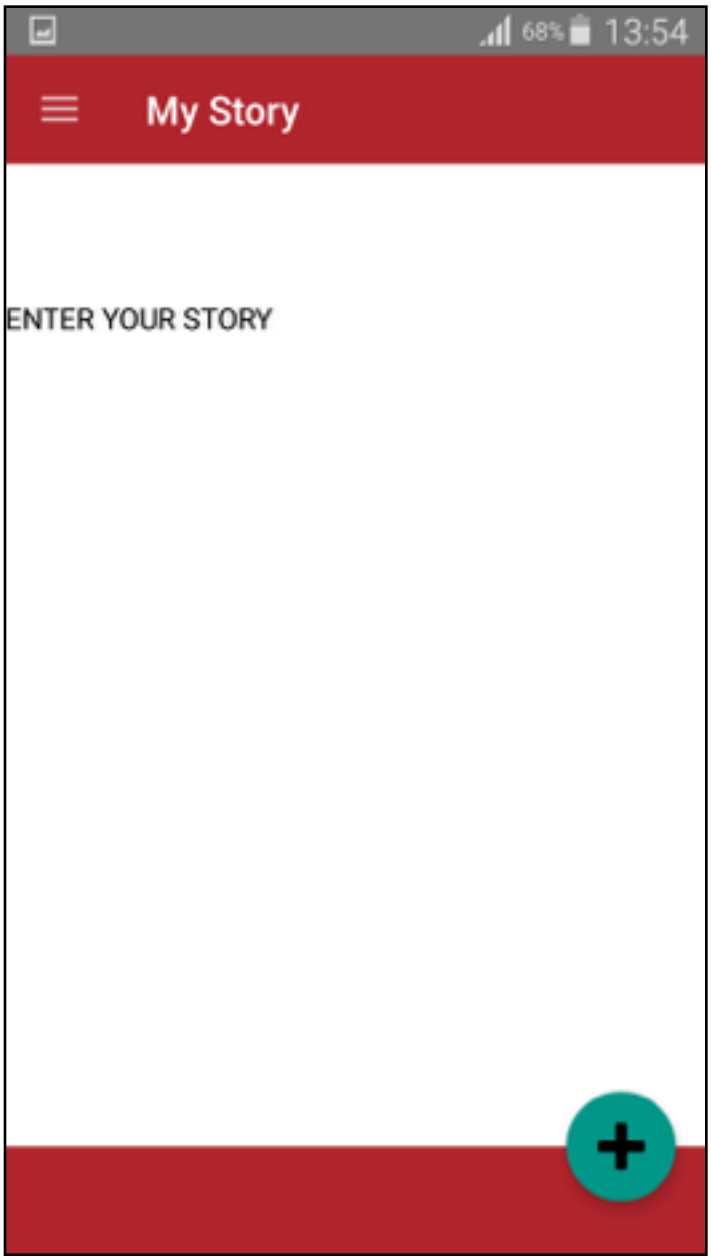
- Quick Call to Hospitals Around You -> Provides a list of hospitals around you. Includes a quick call feature

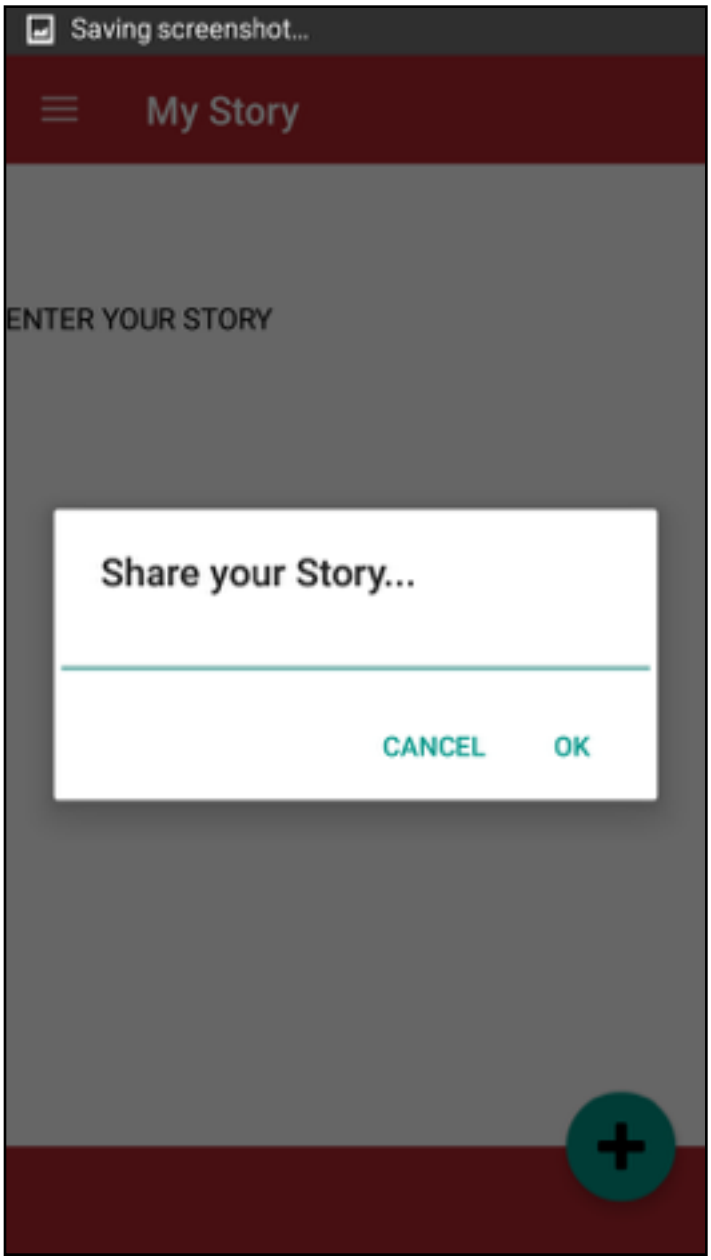
- Navigation Drawer -> A navigation drawer across the app to quickly navigate across different activities

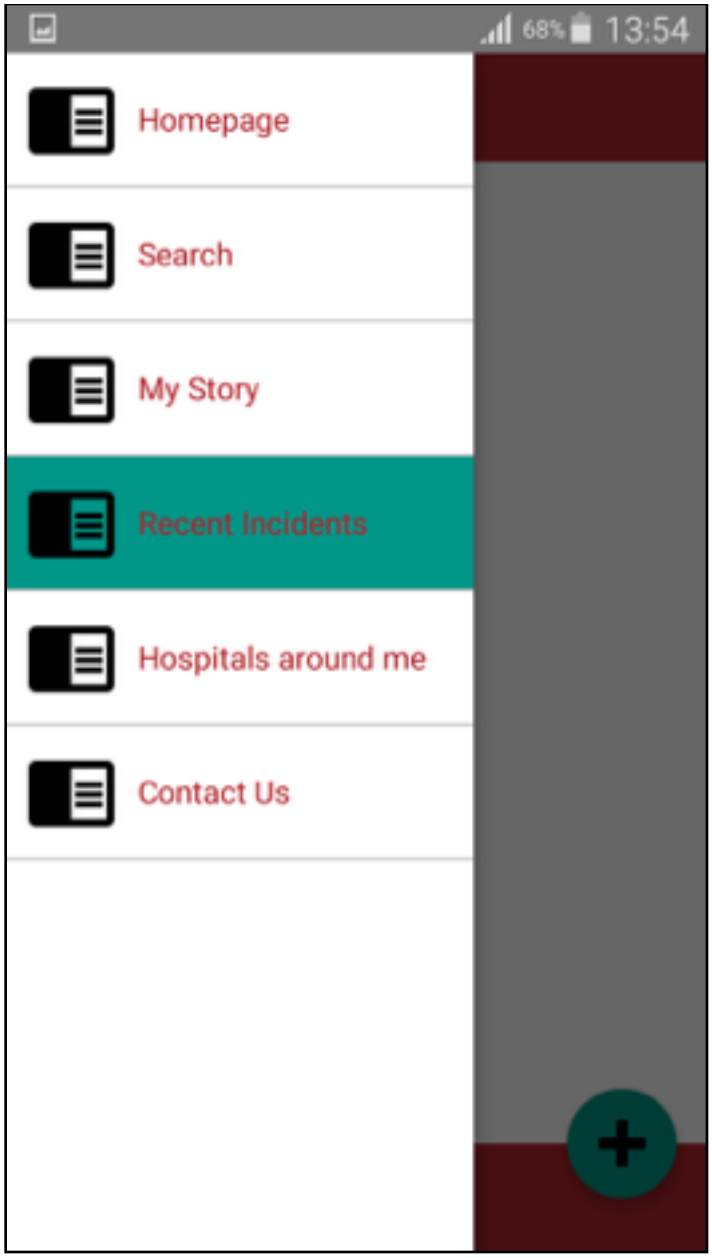
## 2.3 Screenshots

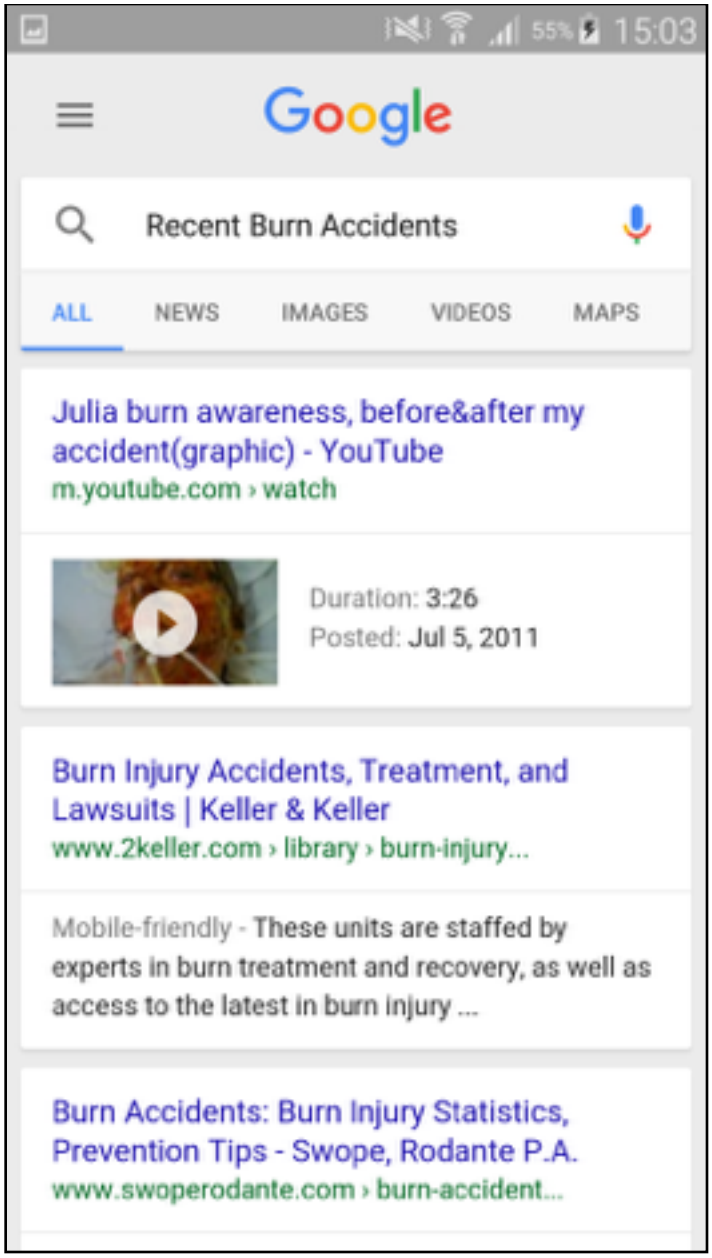


69% 13:54
Search
Bye Burns
Enter keywords...
SEARCH

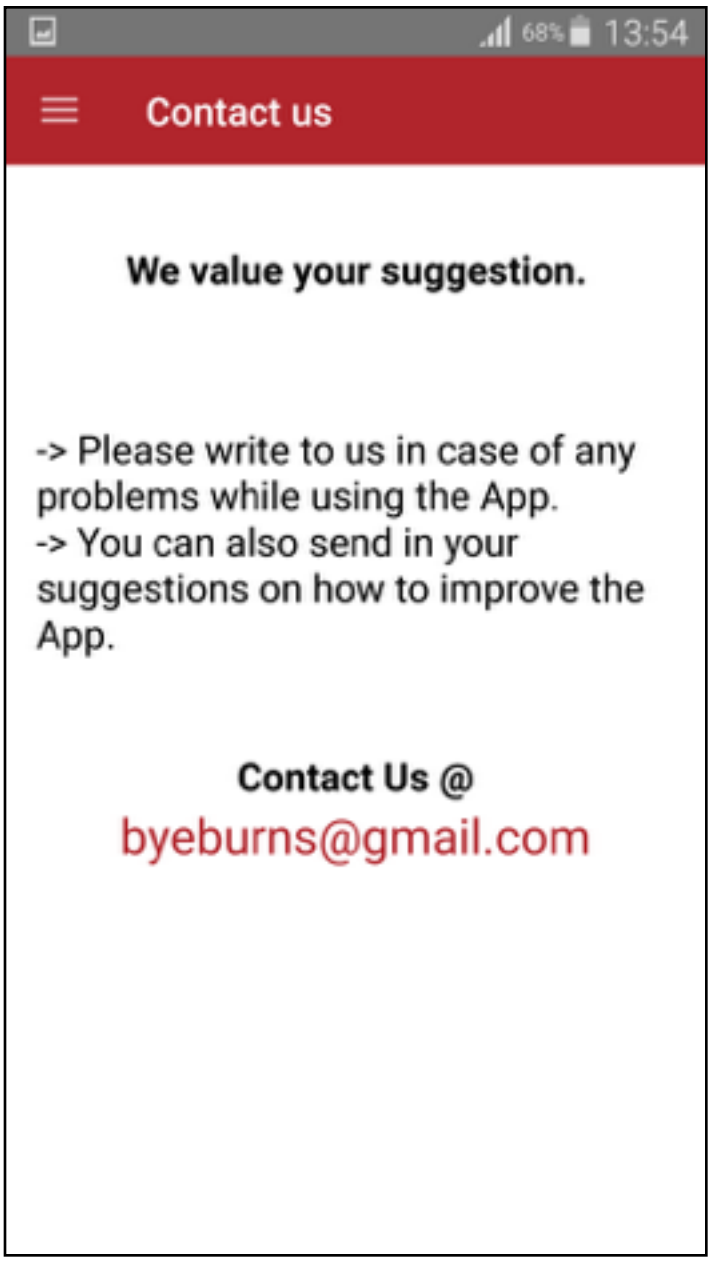

Saving screenshot...
Hospitals around me
Burns Department, Safdarjung Hospital
Beside Blood Bank, Ansari Nagar West, New Delhi, Delhi 110016
011-26165060
Burns and Trauma Rearch Center
5th Floor, Vinayak Hospital, Captain Vijyant Thapar Marg, Sector 27, Noida, Uttar Pradesh 201301
0120-2544000
Ram Manohar Lohia Hospital
President's Estate, New Delhi, Delhi 110001
011-23365525
Kalra Hospital
Vashisht Kumar Gulla Marg, West Punjabi Bagh, New Delhi, Delhi 110026
011-25100000
Sir Ganga Ram Hospital
Rajinder Nagar, New Delhi, Delhi 110060
011-25750000
Lok Nayak Hospital
2, Near Delhi Gate, JN Marg, New Delhi, Delhi 110002
011-23230733

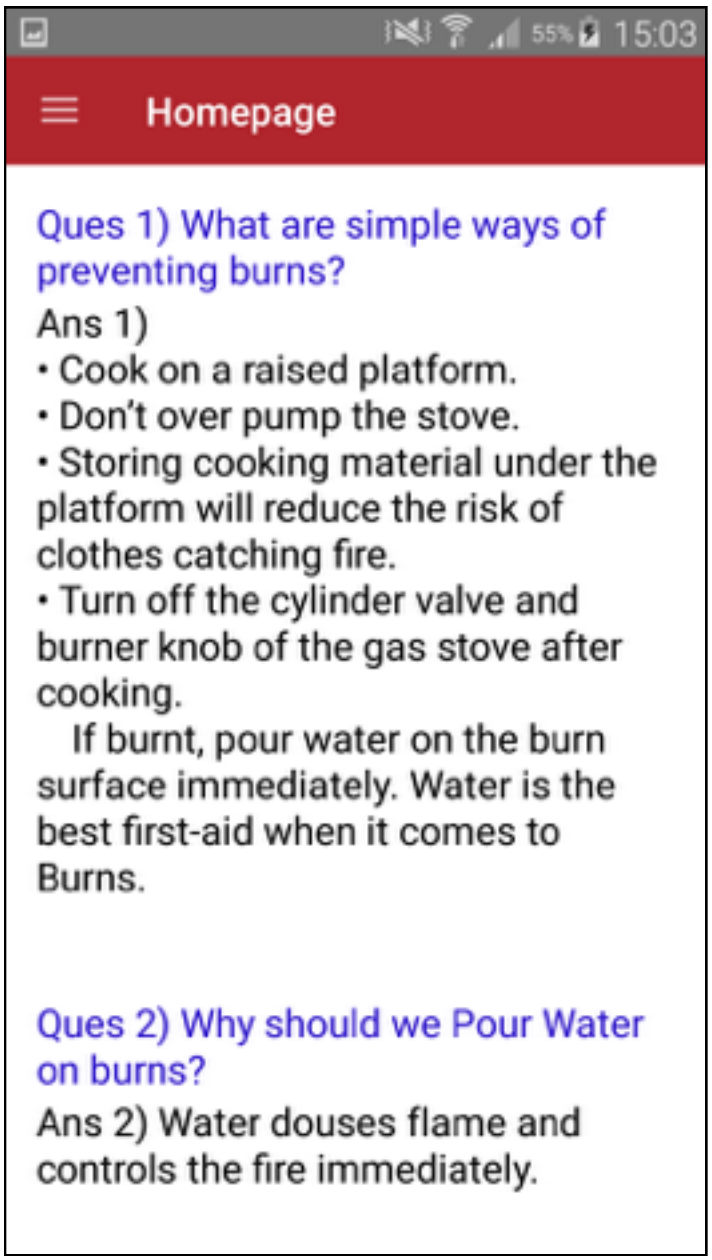

68% 13:54
My Story
ENTER YOUR STORY

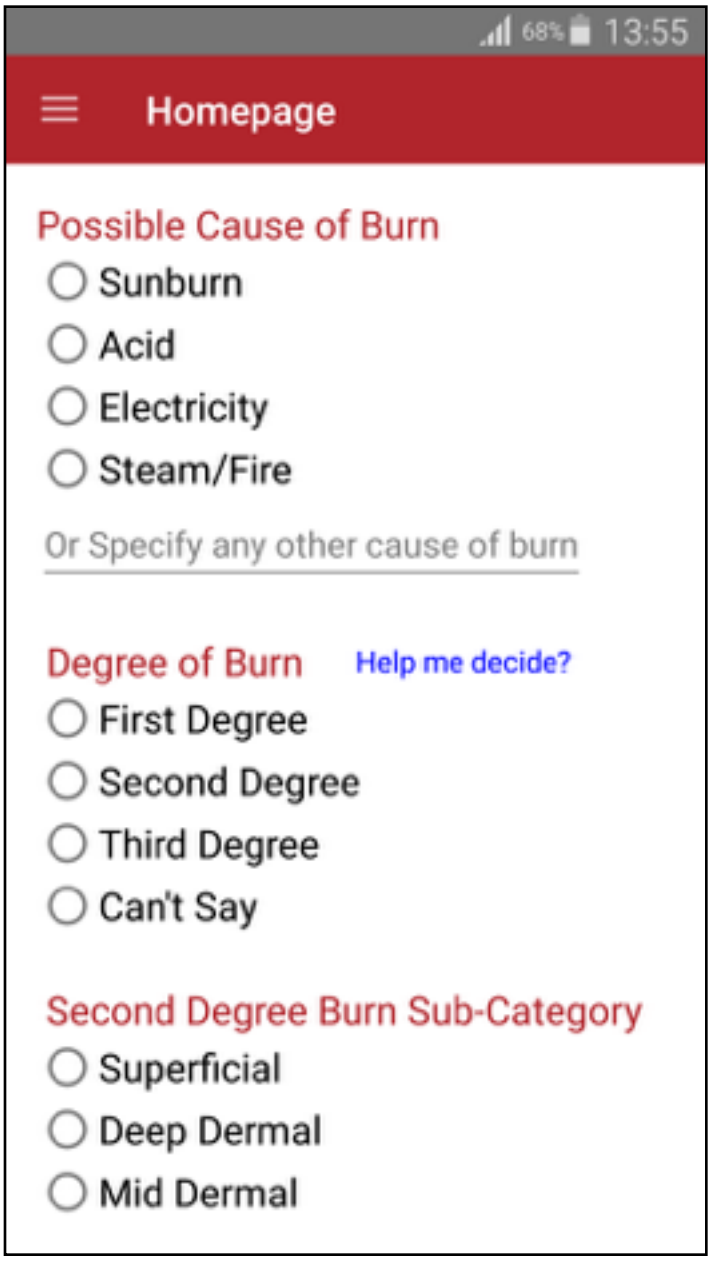

Saving screenshot...
My Story
ENTER YOUR STORY
Share your Story...
CANCEL
OK

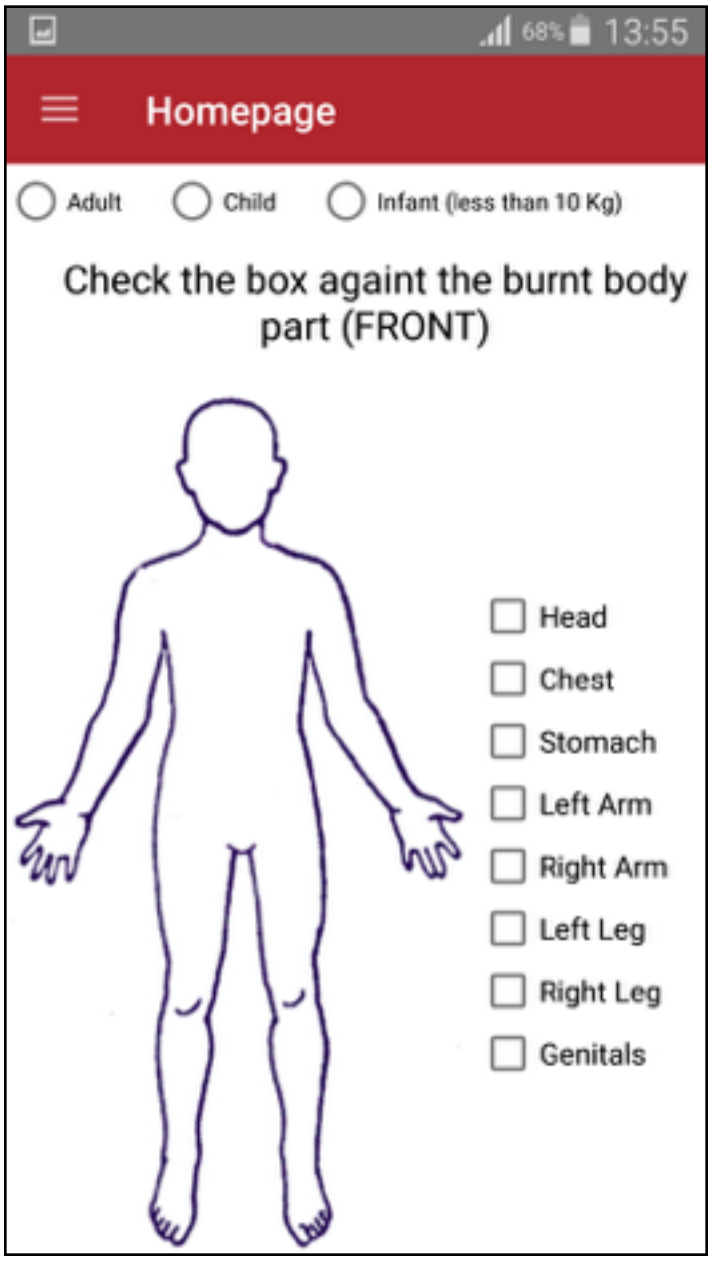

68% 13:54
Homepage
Search
My Story
Recent Incidents
Hospitals around me
Contact Us

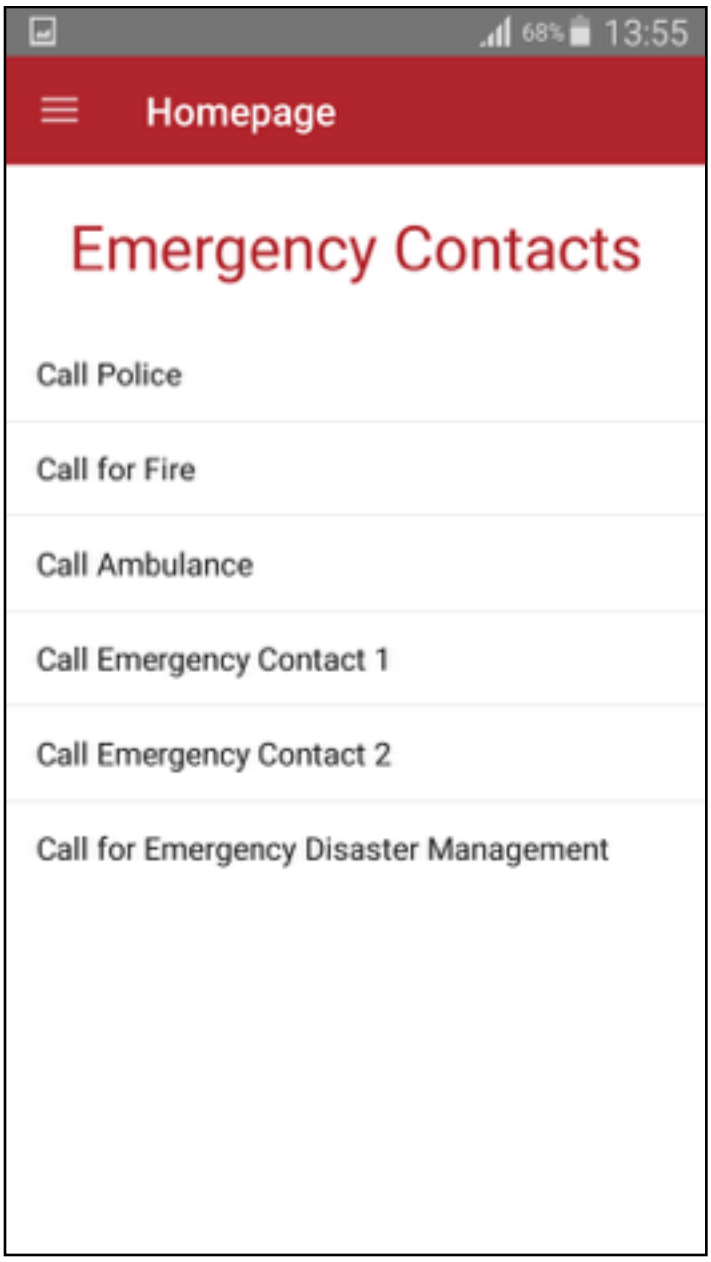

55% 15:03
Google
Recent Burn Accidents
ALL
NEWS
IMAGES
VIDEOS
MAPS
Julia burn awareness, before&after my accident(graphic) - YouTube
m.youtube.com › watch
Duration: 3:26
Posted: Jul 5, 2011
Burn Injury Accidents, Treatment, and Lawsuits | Keller & Keller
www.2keller.com › library › burn-injury...
Mobile-friendly - These units are staffed by experts in burn treatment and recovery, as well as access to the latest in burn injury ...
Burn Accidents: Burn Injury Statistics, Prevention Tips - Swope, Rodante P.A.
www.swoperodante.com › burn-accident...


68% 13:54
Contact us
We value your suggestion.
-> Please write to us in case of any problems while using the App.
-> You can also send in your suggestions on how to improve the App.
Contact Us @
byeburns@gmail.com


55% 15:03
Homepage
Ques 1) What are simple ways of preventing burns?
Ans 1)
• Cook on a raised platform.
• Don't over pump the stove.
• Storing cooking material under the platform will reduce the risk of clothes catching fire.
• Turn off the cylinder valve and burner knob of the gas stove after cooking.
If burnt, pour water on the burn surface immediately. Water is the best first-aid when it comes to Burns.
Ques 2) Why should we Pour Water on burns?
Ans 2) Water douses flame and controls the fire immediately.


68% 13:55
Homepage
Possible Cause of Burn
Sunburn
Acid
Electricity
Steam/Fire
Or Specify any other cause of burn
Degree of Burn
Help me decide?
First Degree
Second Degree
Third Degree
Can't Say
Second Degree Burn Sub-Category
Superficial
Deep Dermal
Mid Dermal


68% 13:55
Homepage
Adult
Child
Infant (less than 10 Kg)
Check the box againt the burnt body part (FRONT)
Head
Chest
Stomach
Left Arm
Right Arm
Left Leg
Right Leg
Genitals


68% 13:55
Homepage
Emergency Contacts
Call Police
Call for Fire
Call Ambulance
Call Emergency Contact 1
Call Emergency Contact 2
Call for Emergency Disaster Management


68% 13:55
Homepage
Check the box against the precaution you've already taken for this Diwali
Have you kept the fireworks away from the reach of children?
Are the fireworks concealed in some cool and dry place?
If you have pets, have you tied them away from the place you will be burning the crackers at?
Are you lighting crackers in an open space?
Have you placed a bucket of water near the place you are going to burn crackers?
Have you checked that no one near you is wearing loose clothes?
Have you made sure that children do not light firecrackers?
Are you at a safe distance from firecrackers?
Make sure not to keep the crackers in you


Saving screenshot...
Homepage
Types Of Burns
Causes Of Burns
Diwali
Accidents at Home
FAQs
FAQs
Statistics


67% 13:55
Homepage
FIRE:
This is the most common cause of burns. You may have heard of marriage tents catching fire or a jhuggi / slum cluster catching fire, or a sari catching fire in the kitchen.
Burns by Hot Liquid:
At times, a cup of hot tea or milk is spilled on hand or feet and causes a burn. A utensil with boiling water or milk may fall from a height over a small child. Infants sometimes can fall into a bucket with hot water taken for bathing or washing clothes.
Burns Due to Electric

## 2.4 Future Prospects

- Connecting the Matlab code with the App so that users can upload a picture and the degree prediction can take place on the server
- Connecting the users with actual doctors who can provide consultation remotely
- Having a list of available doctors near the patient (Dynamic)
- Include features to display the number of beds available in various hospitals so that the user does not wander from hospital to hospital
- A social platform for the burn victims to share their stories
- Extending the app to include hospitals outside Delhi too

# 3. Research Component

## 3.1 Preprocessing of Data

Anomalies in images like blurriness, Salt Pepper Noises can be removed using the following techniques:

**Erosion followed by Dilation ->** Opening Operation is used to basic noise removal where small artifacts present in the image get removed.

**Smoothing ->** To remove any sharp changes and distortions

**Median Filtering ->** To get rid of any Salt and Pepper Noise

(Refer to code in Appendix 3.1)

## 3.2 Feature Extraction

### 3.2.2 Harris Feature Extraction

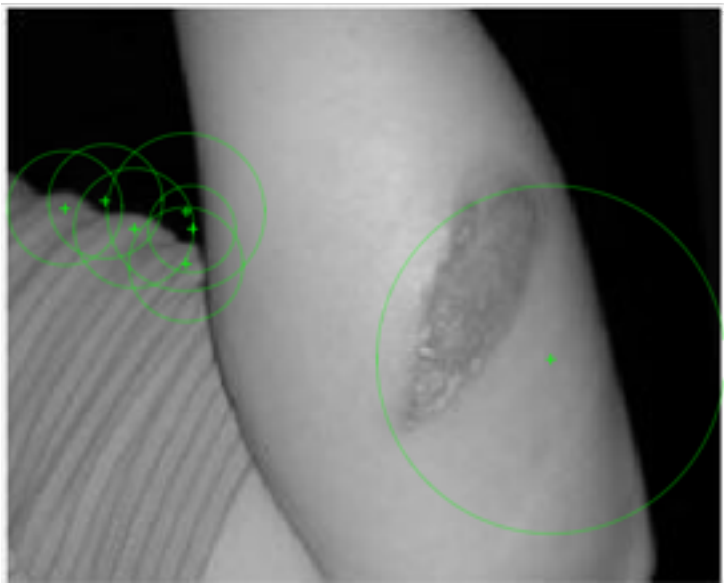
#### 3.2.2 a Extraction of top 10 features of the image

```
I = imread('/Users/Simran/Desktop/DB/arm1.jpg');
I = rgb2gray(I)
points = detectHarrisFeatures(I);
imshow(I); hold on;
plot(points.selectStrongest(10));
```

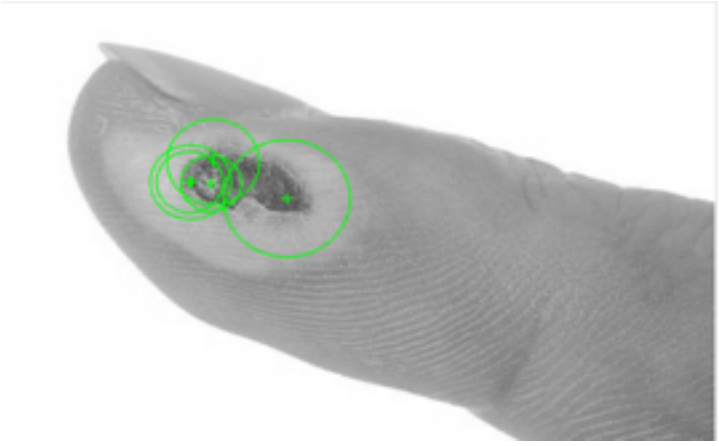
### 3.2.3 SURF Feature Extraction

#### 3.2.3 a Extraction of 10 best features

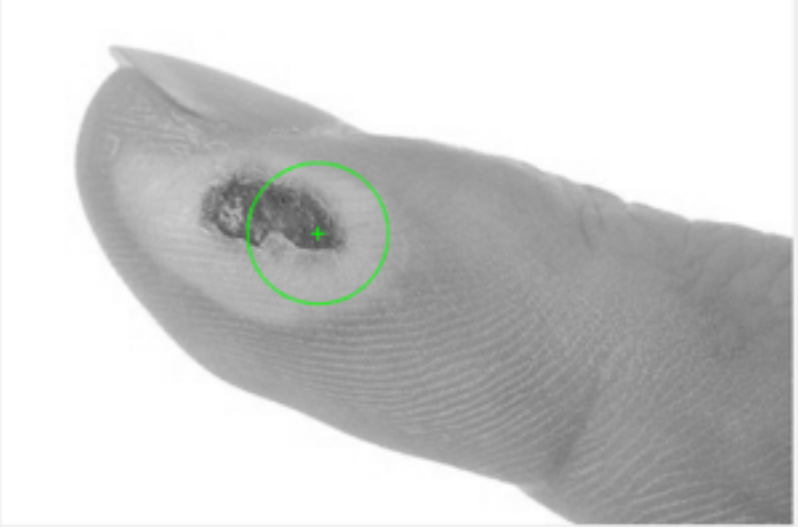
```
I = imread('/Users/Simran/Desktop/DB/arm1.jpg');
I = rgb2gray(I)
points = detectSURFFeatures(I);
imshow(I); hold on;
plot(points.selectStrongest(10));
```



#### 3.2.3 b Extraction of 5 best features



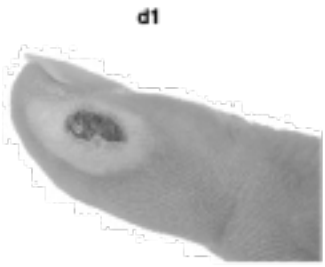
### 3.2.3 b Extraction of 1 best feature

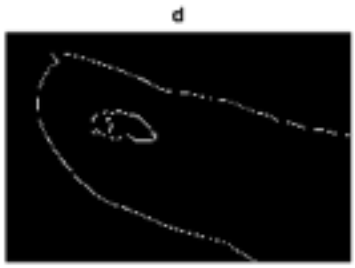


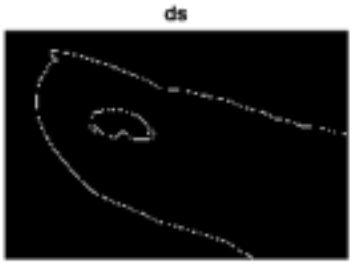
Extraction of feature points was also giving the features of the body parts along with the burnt region.

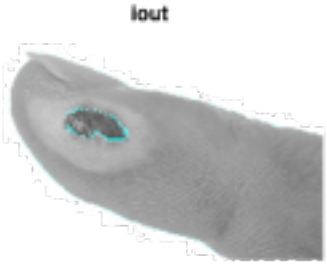
### 3.2.4 Contour Detection

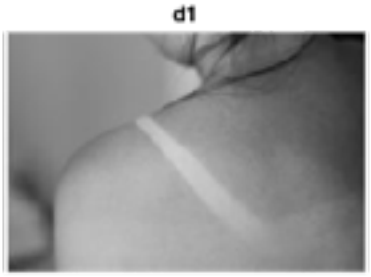
```
I = imread('/Users/Simran/Desktop/DB/thumb1.jpg');
I = rgb2gray(I)
% points = detectSURFFeatures(I);
% imshow(I); hold on;
% plot(points.selectStrongest(1));

d1 = double(I)./255;  %# Load the image, scale from 0 to 1
subplot(2,2,1); imshow(d1); title('d1');    %# Plot the original image
d = edge(d1,'canny',.6);                    %# Perform Canny edge detection
subplot(2,2,2); imshow(d); title('d');      %# Plot the edges
ds = bwareaopen(d,40);                      %# Remove small edge objects
subplot(2,2,3); imshow(ds); title('ds');    %# Plot the remaining edges
iout = d1;
```


d1


d


ds

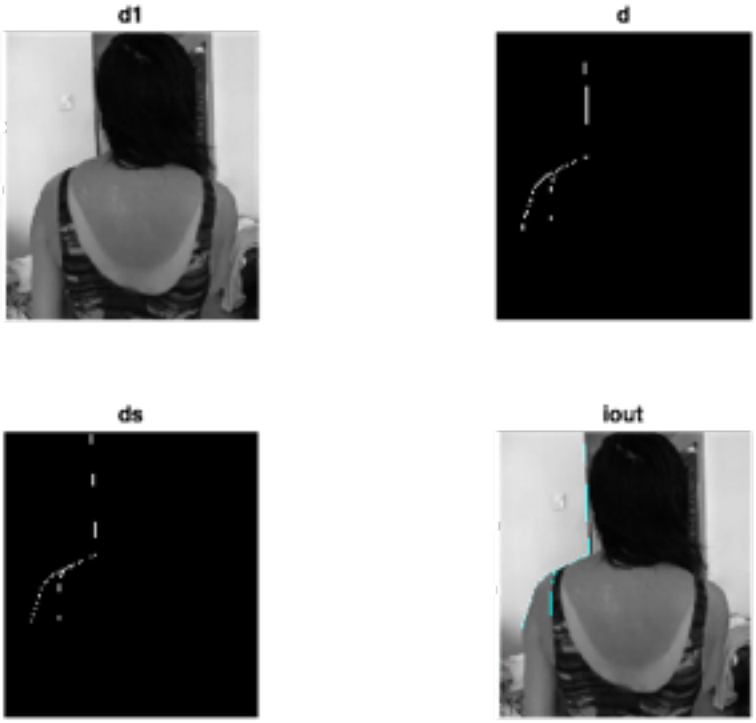

iout

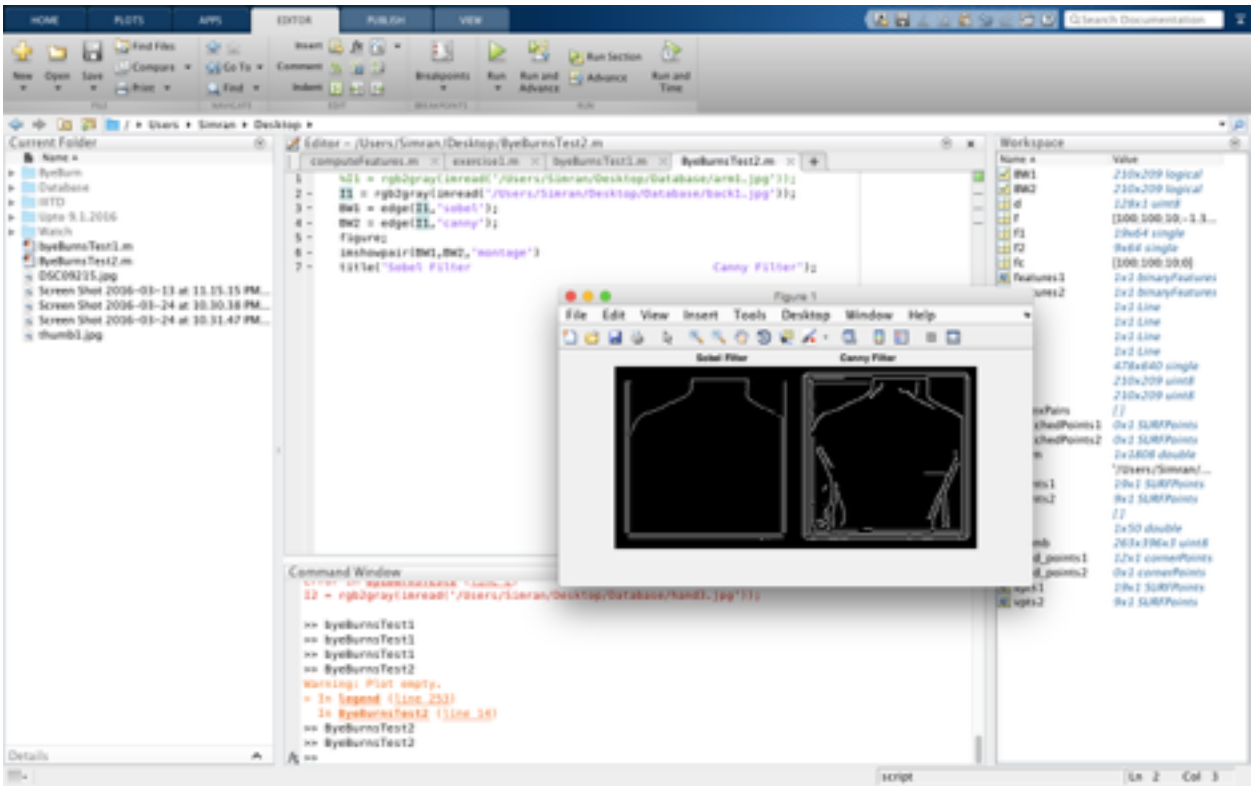

d1


d


ds


iout


d1
d
ds
iout



## 3.3 Bag of Words Implementation for classification of images into 1st, 2nd and 3rd Degree

**Steps**

1. Linking of database to matlab
2. Loading Image Datasets
3. Preparing Training and Validation Datasets
4. Create a Visual Vocabulary
5. Training Image Category Classifier
6. Evaluating Classifier Performance
7. Trying the newly trained classifier to test images

## Output Images

```
>> byeBurnsAlgo

ans =

    'firstDegree'    'secondDegree'    'thirdDegree'

ans =

    16    12    12


ans =

    12    12    12


Creating Bag-Of-Features from 3 image sets.
-------------------------------------------
* Image set 1: firstDegree.
* Image set 2: secondDegree.
* Image set 3: thirdDegree.

* Extracting SURF features using the Grid selection method.
** The GridStep is [8 8] and the BlockWidth is [32 64 96 128].

* Extracting features from 4 images in image set 1...done. Extracted 119488 features.
* Extracting features from 4 images in image set 2...done. Extracted 6544 features.
* Extracting features from 4 images in image set 3...done. Extracted 30352 features.

* Keeping 80 percent of the strongest features from each image set.

* Balancing the number of features across all image sets to improve clustering.
** Image set 2 has the least number of strongest features: 5235.
** Using the strongest 5235 features from each of the other image sets.

* Using K-Means clustering to create a 500 word visual vocabulary.
* Number of features          : 15705
* Number of clusters (K)      : 500
```

```
* Initializing cluster centers...100.00%.
* Clustering...completed 24/100 iterations (~0.13 seconds/iteration)...converged in 24 iterations.

* Finished creating Bag-Of-Features


Training an image category classifier for 3 categories.
--------------------------------------------------------
* Category 1: firstDegree
* Category 2: secondDegree
* Category 3: thirdDegree

* Encoding features for category 1...done.
* Encoding features for category 2...done.
* Encoding features for category 3...done.

* Finished training the category classifier. Use evaluate to test the classifier on a test set.


Evaluating image category classifier for 3 categories.
-------------------------------------------------------

* Category 1: firstDegree
* Category 2: secondDegree
* Category 3: thirdDegree

* Evaluating 4 images from category 1...done.
* Evaluating 4 images from category 2...done.
* Evaluating 4 images from category 3...done.

* Finished evaluating all the test sets.

* The confusion matrix for this test set is:
```

```
* The confusion matrix for this test set is:


                                PREDICTED
KNOWN           | firstDegree   secondDegree   thirdDegree
-------------------------------------------------------------
firstDegree     | 1.00          0.00           0.00
secondDegree    | 0.00          1.00           0.00
thirdDegree     | 0.00          0.00           1.00

* Average Accuracy is 1.00.


Evaluating image category classifier for 3 categories.
-------------------------------------------------------

* Category 1: firstDegree
* Category 2: secondDegree
* Category 3: thirdDegree

* Evaluating 8 images from category 1...done.
* Evaluating 8 images from category 2...done.
* Evaluating 8 images from category 3...done.

* Finished evaluating all the test sets.

* The confusion matrix for this test set is:


                                PREDICTED
KNOWN           | firstDegree   secondDegree   thirdDegree
-------------------------------------------------------------
firstDegree     | 0.38          0.50           0.12
secondDegree    | 0.00          1.00           0.00
thirdDegree     | 0.00          0.12           0.88

* Average Accuracy is 0.75.
```



# Reading Work

Link To Notes of Papers Read : (https://drive.google.com/open?id=1KCuRgytSVPlrueZ75X8GmLqZqJQXWlTDDqiiC_luzZQ)

Sir's paper: http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=6779396


[1] http://www.who.int/mediacentre/factsheets/fs365/en/

[2] http://www.who.int/bulletin/volumes/87/10/08-059733/en/

[3] http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6029043

[4] http://www.askdrsears.com/topics/health-concerns/skin-care/burns(General info about burns)

[5] http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3038388/

[6] http://www.burnsjournal.com/article/S0305-4179(08)00041-7/references

[7] http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2658315/

[8] http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6172044 // very good

[9]http://ieeexplore.ieee.org/xpl/login.jsp?tp=&arnumber=4052269&url=http%3A%2F%2Fieeexplore.ieee.org%2Fxpls%2Fabs_all.jsp%3Farnumber%3D4052269

[10] https://play.google.com/store/apps/details?id=com.cube.arc.fa&hl=en

[11] http://www.amazon.co.uk/Bailey-Loves-Practice-Surgery-Edition/dp/034093932X ~ Book

[12]http://ieeexplore.ieee.org/xpl/login.jsp?tp=&arnumber=1017338&url=http%3A%2F%2Fieeexplore.ieee.org%2Fxpls%2Fabs_all.jsp%3Farnumber%3D1017338

[13] http://www.ncbi.nlm.nih.gov/pubmed/15774281

[14] Segmentation of Burn Images Classification of Their Depths by Color and Texture Information

[15]http://www.aci.health.nsw.gov.au/__data/assets/pdf_file/0019/162631/Clinical_Practice_Guidelines_2012.pdf [Yet to read]

[16]http://www.aci.health.nsw.gov.au/__data/assets/pdf_file/0019/162631/Clinical_Practice_Guidelines_2012.pdf

# Bibliography

>http://www.etoolsage.com/Calculator/TBSA_Calculation.asp?toolsort=1500

>http://in.mathworks.com/help/vision/examples/image-category-classification-using-bag-of-features.html

> Android Documentation http://developer.android.com/index.html

# Appendix

**Code 3.1 (Preprocessing of Image)**

**-> https://drive.google.com/open?id=0B11CcnfAGbdUQVFBSFgtTTlqQzA**

**Code 3.2.2 (Harris Feature Extraction)**

**-> https://drive.google.com/open?id=0B11CcnfAGbdUbzZVdjdkZE05YWM**

**Code for Bag of Words**

**->** https://drive.google.com/open?id=0B11CcnfAGbdUR1FnN0VzT2ZJYUE

**Link to Google Drive with all project related data**

**->** https://drive.google.com/drive/u/1/folders/0B11CcnfAGbdUc1VUS2U1dzJfVHM

**Link to Reading Work**

**->** https://drive.google.com/open?id=1KCuRgytSVPlrueZ75X8GmLqZqJQXWlTDDqiiC_luzZQ

**Link to App Related Data**

**->** https://drive.google.com/open?id=0B11CcnfAGbdUdjFWeU56VXNNSTQ