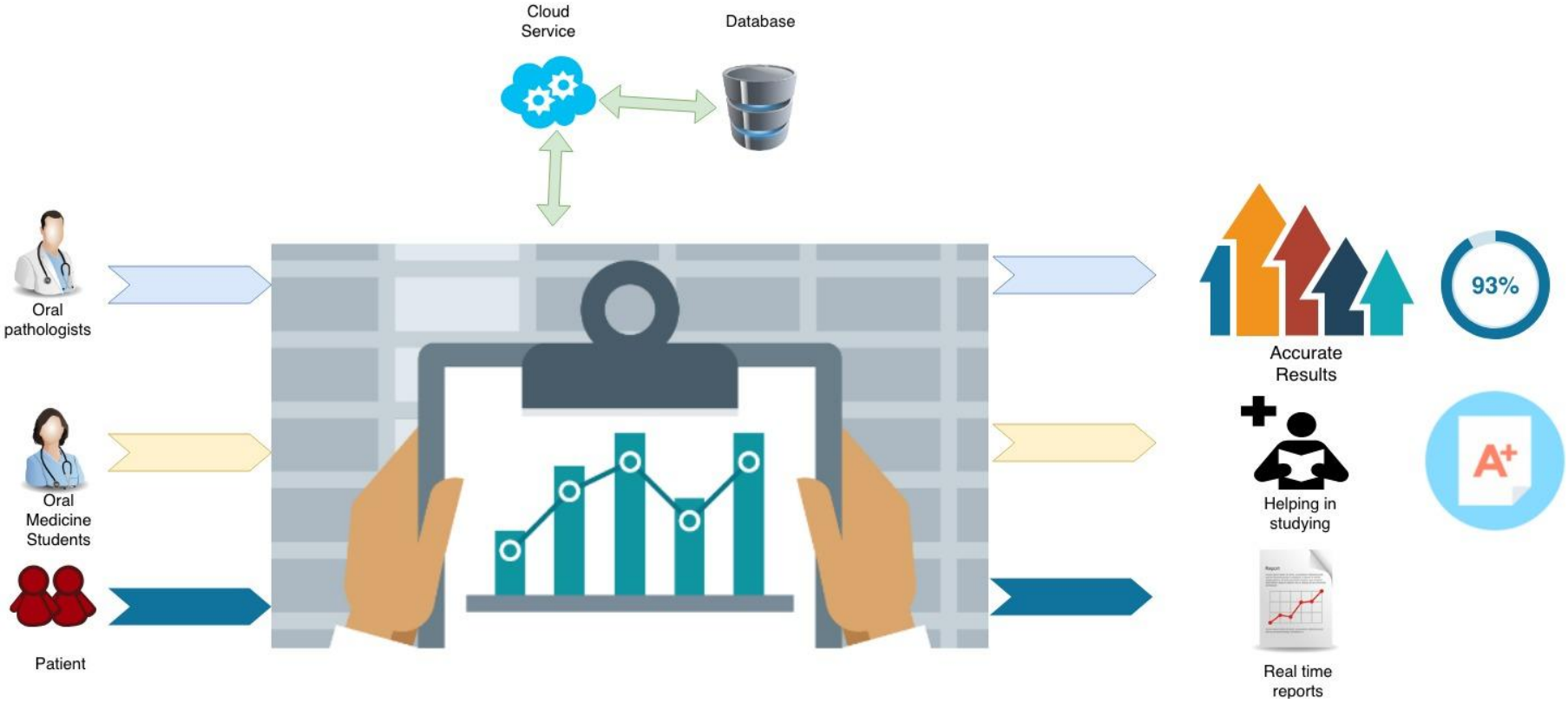
Detection And Classification Of Oral Epithelial Dysplasia

By Mahmoud Ahmed, John Mounir, Youssef Alaa and David Adel
Supervised by Dr. Ashraf Abdelraouf and Eng. Noha El Masry

Objective

"**Automating** the detection and classification of epithelial dysplasia through image processing, but as well as clustering images to increase the **accuracy** of the classification which is normally done by the human eye."

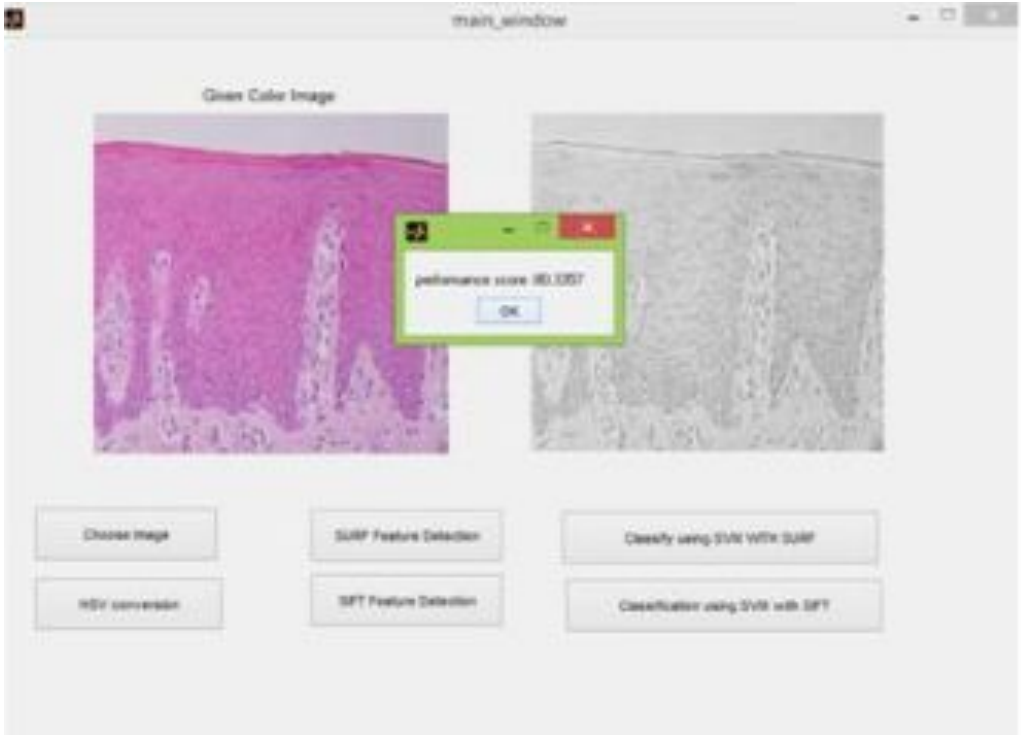
Business Context Diagram



Similar System[1]

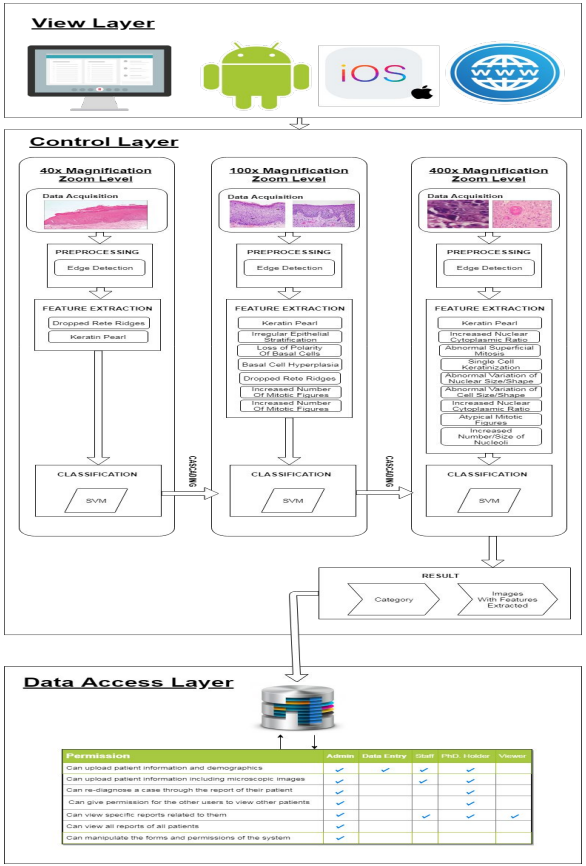
SVM BASED CLASSIFICATION OF EPITHELIAL DYSPLASIA USING SURF AND SIFT FEATURES

- SVM (Support Vector Machine)
- **91.4%** in SURF algorithm
- **84%** in SIFT algorithm.

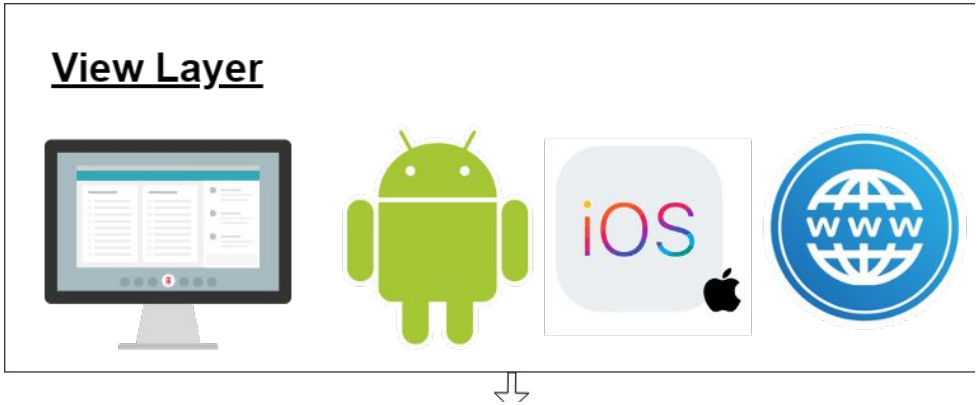


[1]P. Aurchana, P. Dhanalakshmi, and C. Chidambaram, “Svm based classification of epithelial dysplasia using surf and sift features.”

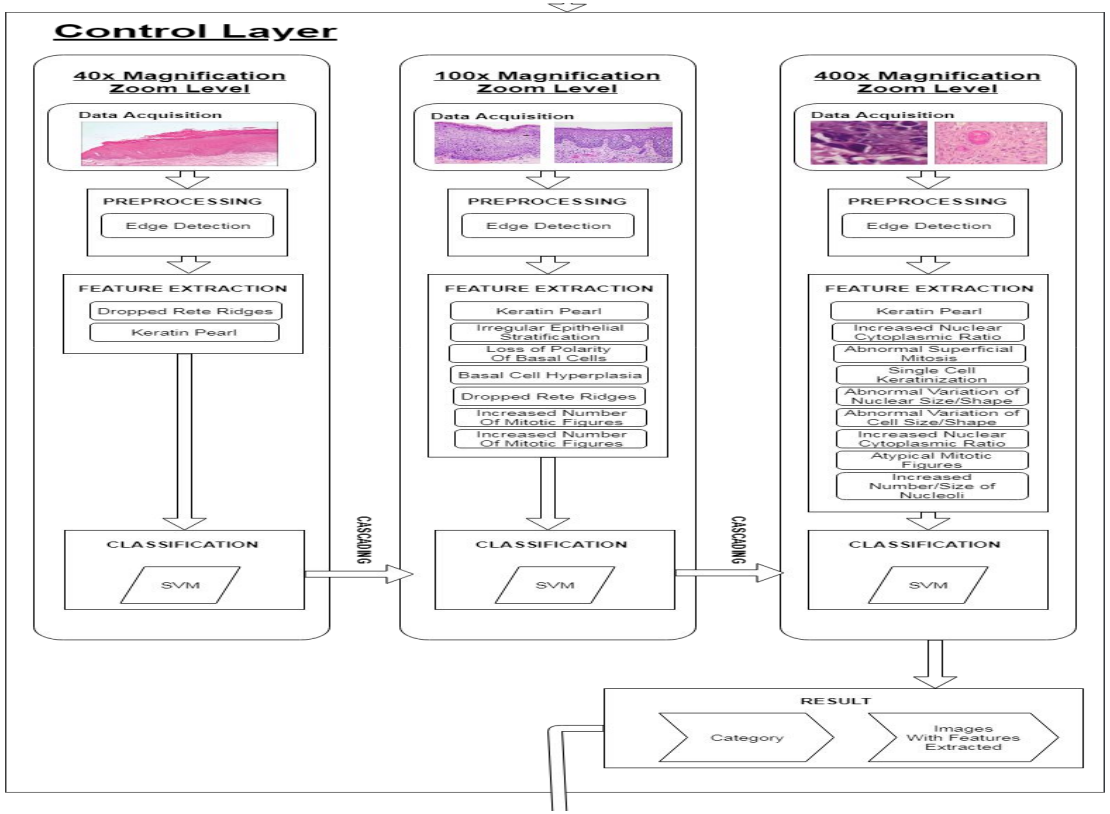
Block Diagram 1/4



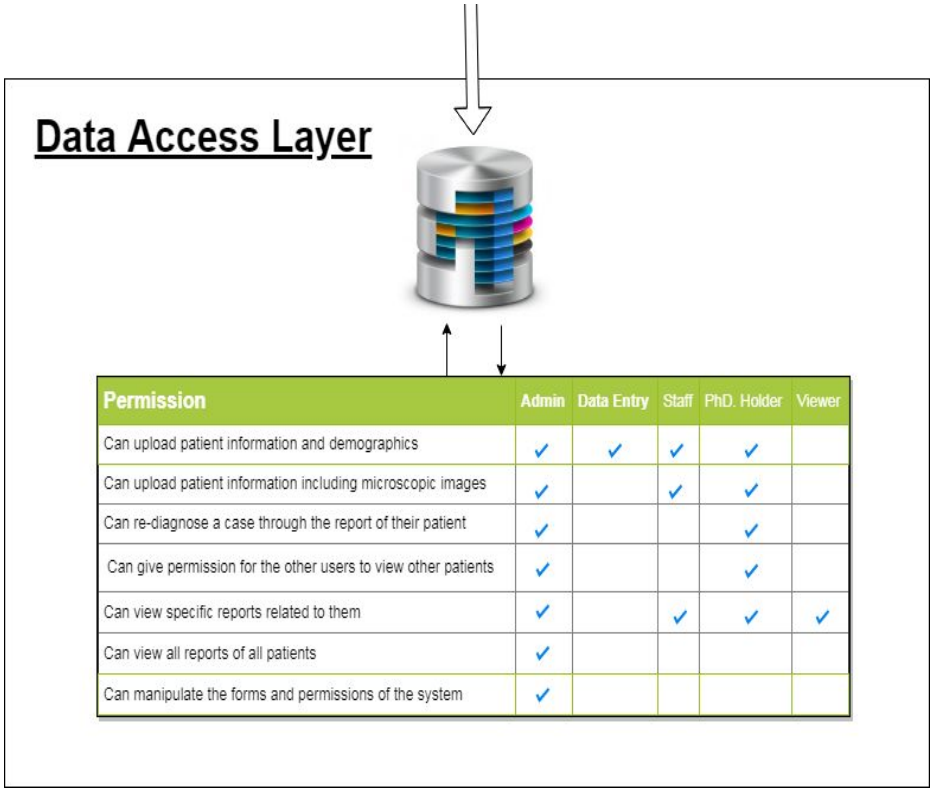
Block Diagram 2/4 - view layer



Block Diagram 3/4 - control layer



Block Diagram 4/4 - data access layer



Permission	Admin	Data Entry	Staff	PhD. Holder	Viewer
Can upload patient information and demographics	✓	✓	✓	✓	
Can upload patient information including microscopic images	✓		✓	✓	
Can re-diagnose a case through the report of their patient	✓			✓	
Can give permission for the other users to view other patients	✓			✓	
Can view specific reports related to them	✓		✓	✓	✓
Can view all reports of all patients	✓				
Can manipulate the forms and permissions of the system	✓				

Functional Requirements

User Manipulation	• Login • CRUD Patients and Employees
Feature Extraction	• getConnectedComps • otsuThreshold • getKeratinPearl
Image Manipulation	• Upload image • Read image • Give Feedback

Non-Functional Requirements

Security

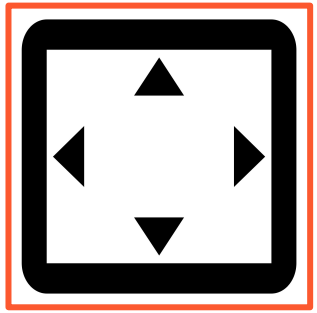
Encryption
Decryption
Hashing

Maintainability

MVC
Singleton
Strategy
Observer

Portability

Different
platforms



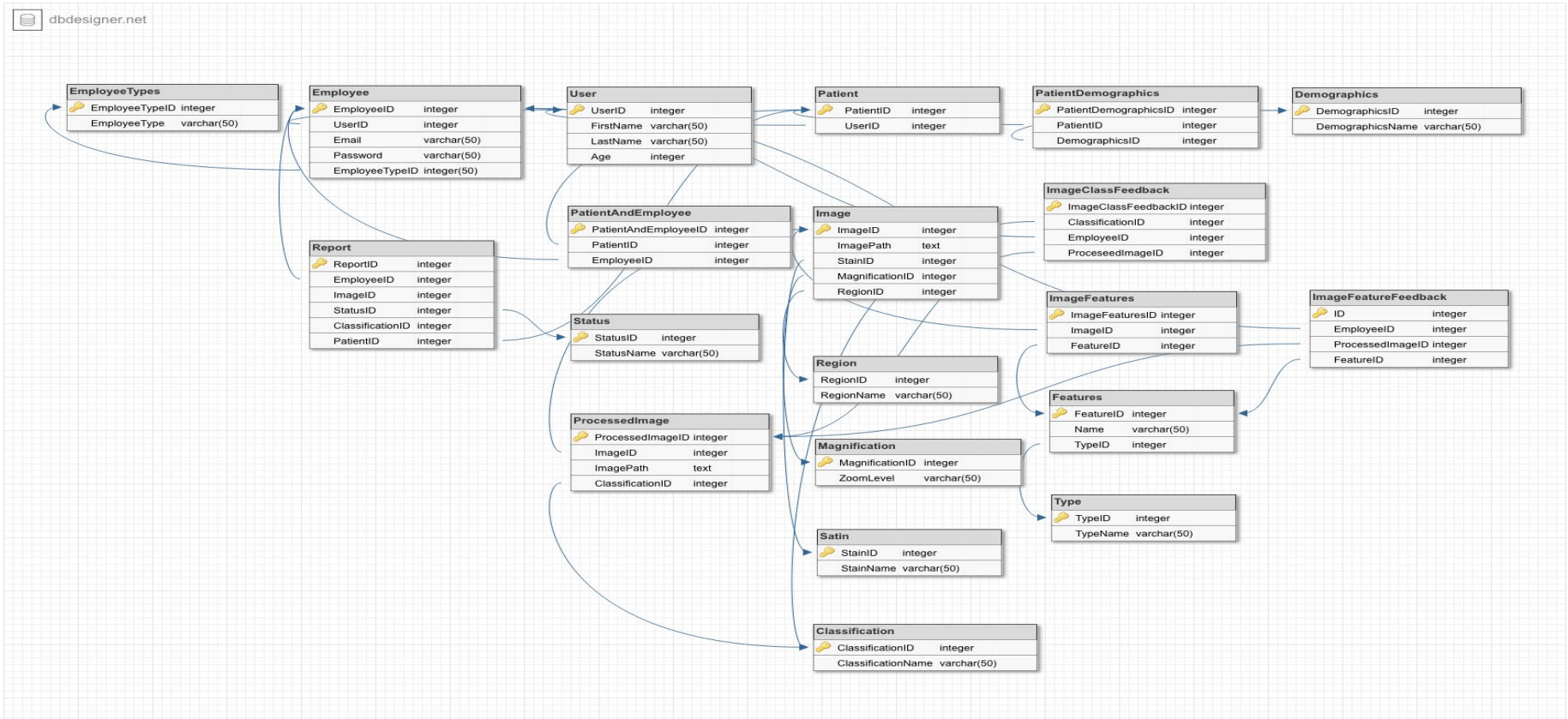
Scalability

System will learn
and train itself

Availability

Cloud server to
avoid failure

Database


dbdesigner.net
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EmployeeTypeID integer
EmployeeType varchar(50)
Employee
EmployeeID integer
UserID integer
Email varchar(50)
Password varchar(50)
EmployeeTypeID integer(50)
User
UserID integer
FirstName varchar(50)
LastName varchar(50)
Age integer
Patient
PatientID integer
UserID integer
PatientDemographics
PatientDemographicsID integer
PatientID integer
DemographicsID integer
Demographics
DemographicsID integer
DemographicsName varchar(50)
ImageClassFeedback
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ProceseedImageID integer
PatientAndEmployee
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PatientID integer
EmployeeID integer
Image
ImageID integer
ImagePath text
StainID integer
MagnificationID integer
RegionID integer
Report
ReportID integer
EmployeeID integer
ImageID integer
StatusID integer
ClassificationID integer
PatientID integer
Status
StatusID integer
StatusName varchar(50)
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ImageFeaturesID integer
ImageID integer
FeatureID integer
ImageFeatureFeedback
ID integer
EmployeeID integer
ProcessedImageID integer
FeatureID integer
Region
RegionID integer
RegionName varchar(50)
Features
FeatureID integer
Name varchar(50)
TypeID integer
ProcessedImage
ProcessedImageID integer
ImageID integer
ImagePath text
ClassificationID integer
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Classification
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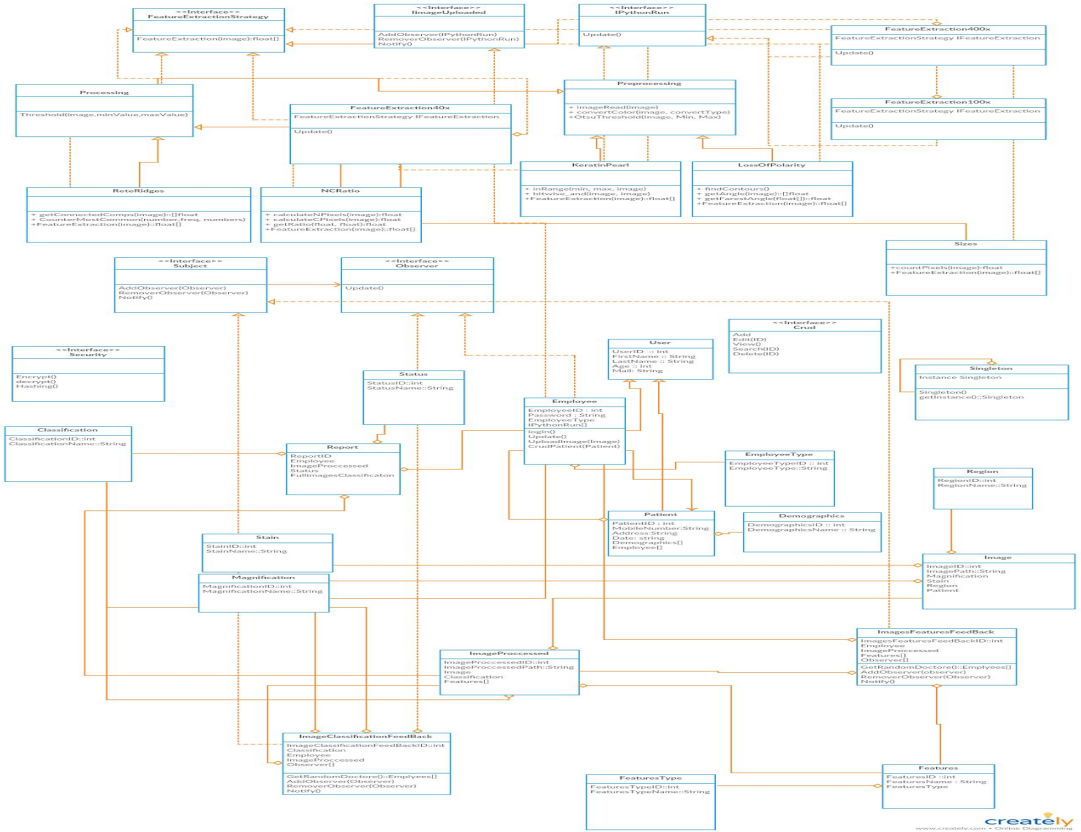
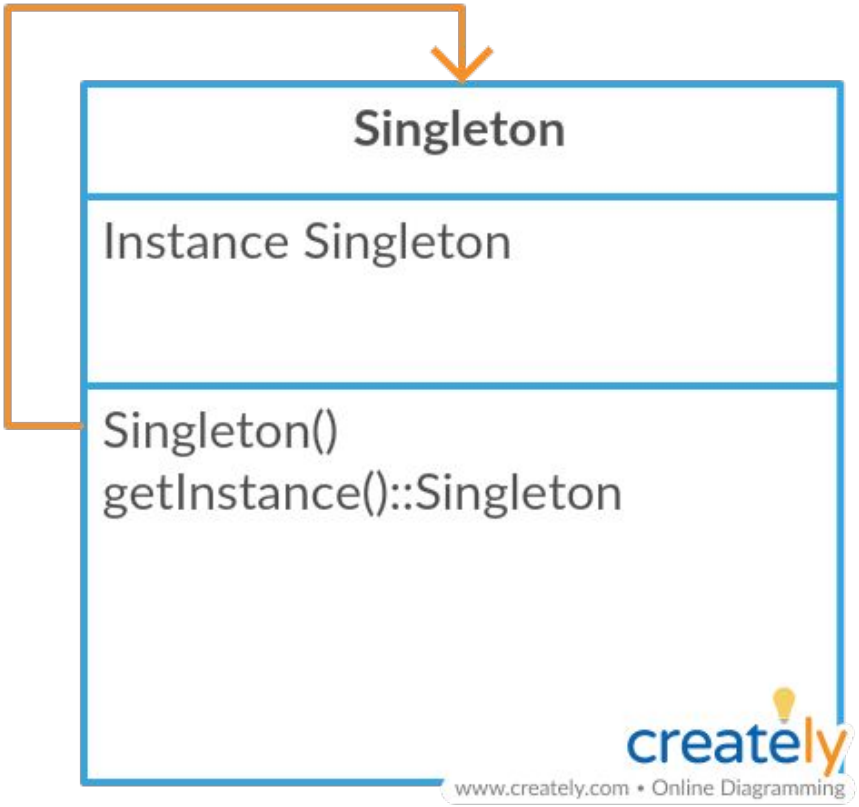
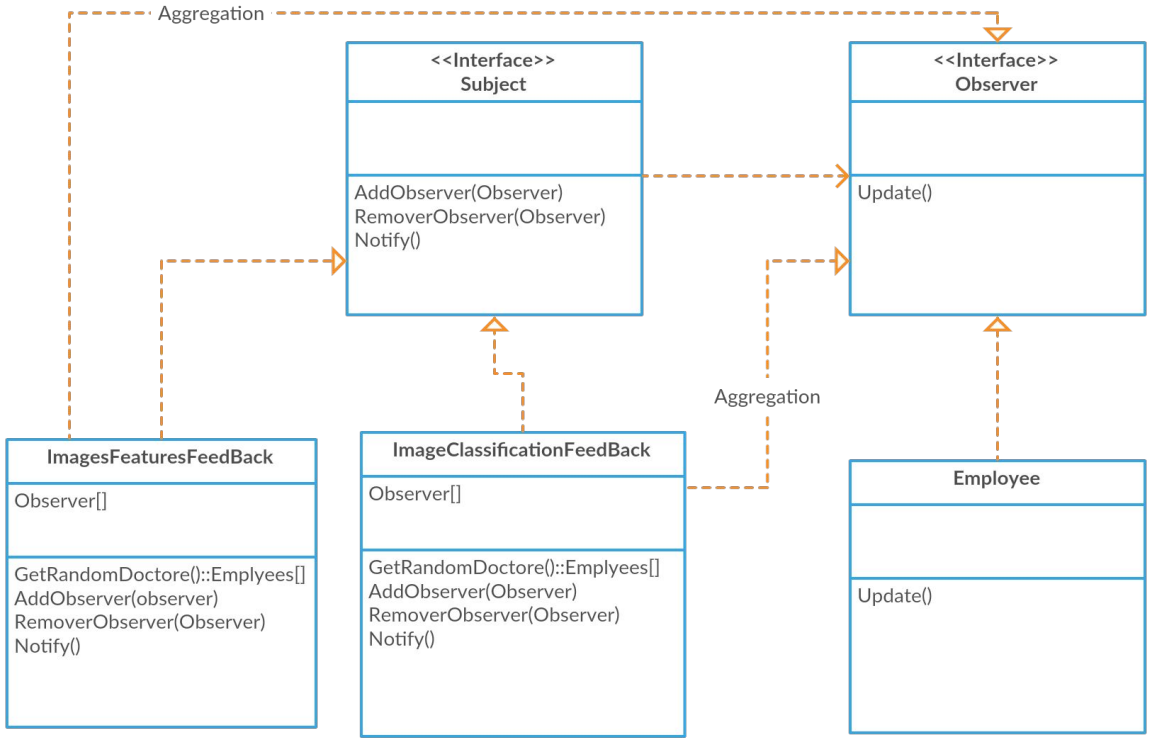
Class Diagram 1/5



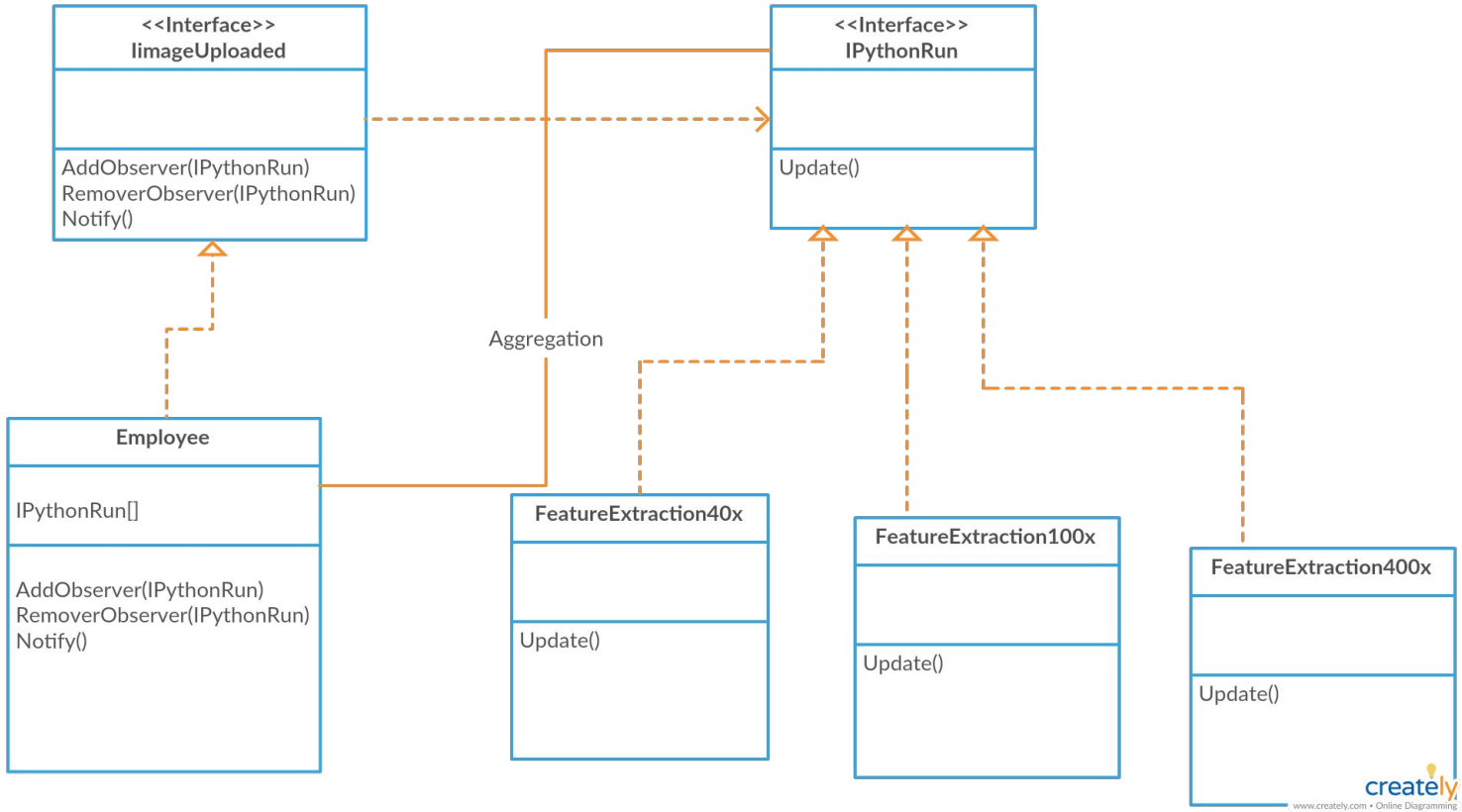
Class Diagram 2/5



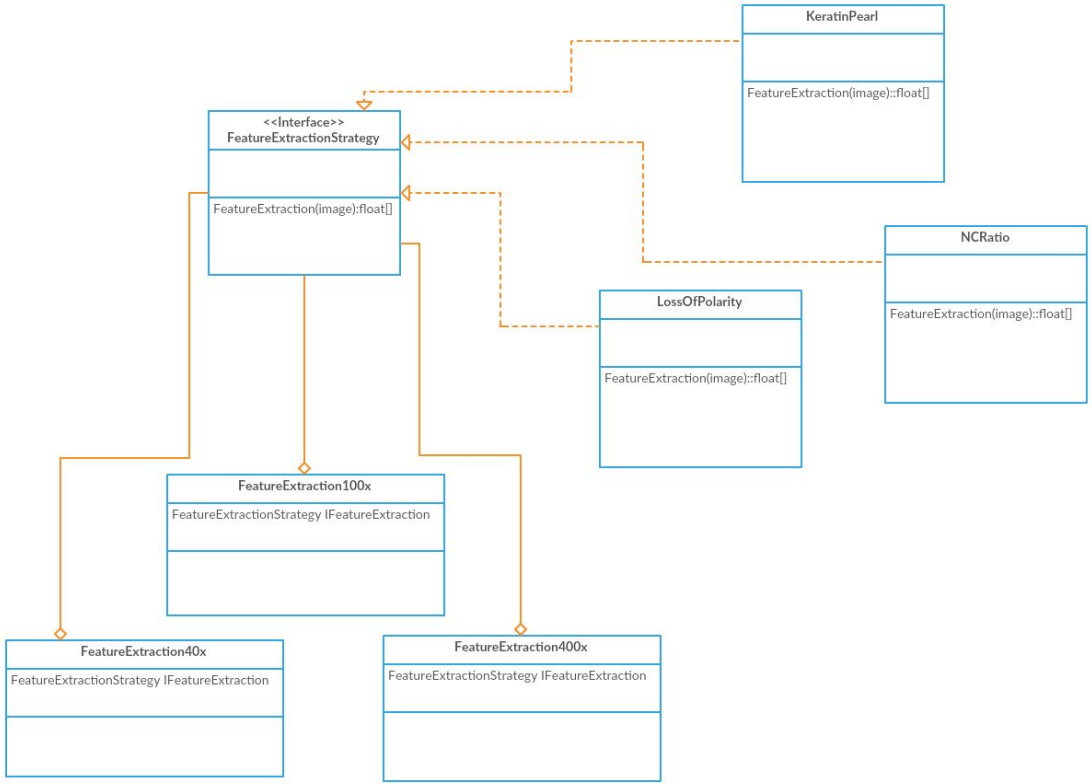
Class Diagram 3/5



Class Diagram 4/5



Class Diagram 5/5



Wireframe

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Upload images

Magnification :

40x Magnification

100x Magnification

400x Magnification

◯ 40x ◉ 100x ◯ 400x

◯ Automatic detection

Stain :

◯ Automatic detection ◯ CLT400 ◉ Hematoxyn

Upload

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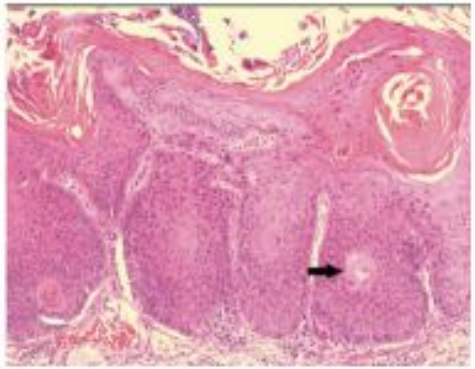
Image Auto-Detection Analysis



Accuracy:

40x Zoom Level: 90%

100x Zoom Level: 8%

400x Zoom Level: 2%

Image is Classified as **40x Zoom Level**

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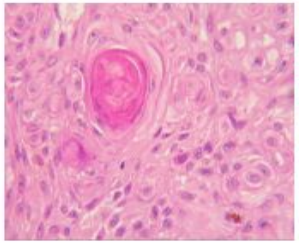
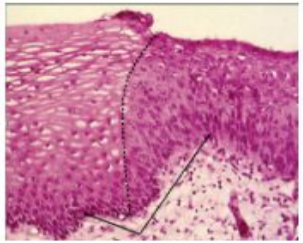
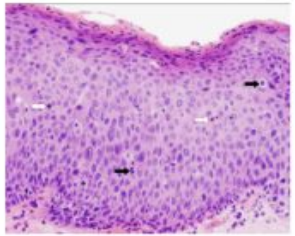
Final Report

Name : Ahmed Hassan Age : 18

Show all

Features	Figures	
Keratin Pearl	Fig.4;Fig.5	☑
duplicate cells		○
Loss of polarity	Fig2	☑
Mitosis	Fig3	⊙
Drop ReteRidge		☐

Remarks : ☑ Smoker ☐ Spicy eater ☑ HBP

☐ Diabetic ☑ obese ☐ LBP

Give Feedback

Classification : Mild Epithelial Dysplasia

Prev Done

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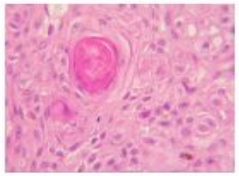
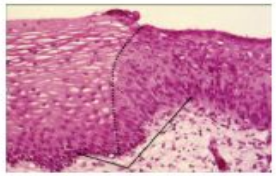
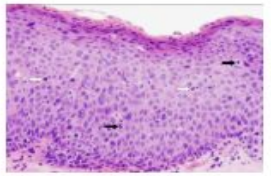
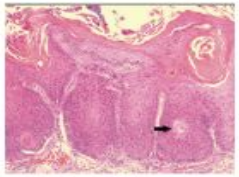
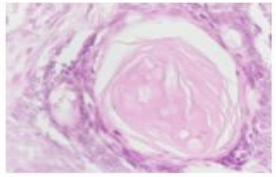
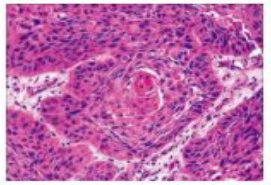
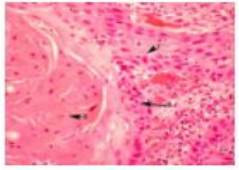
All Images

Name : Ahmed Hassan Age : 18

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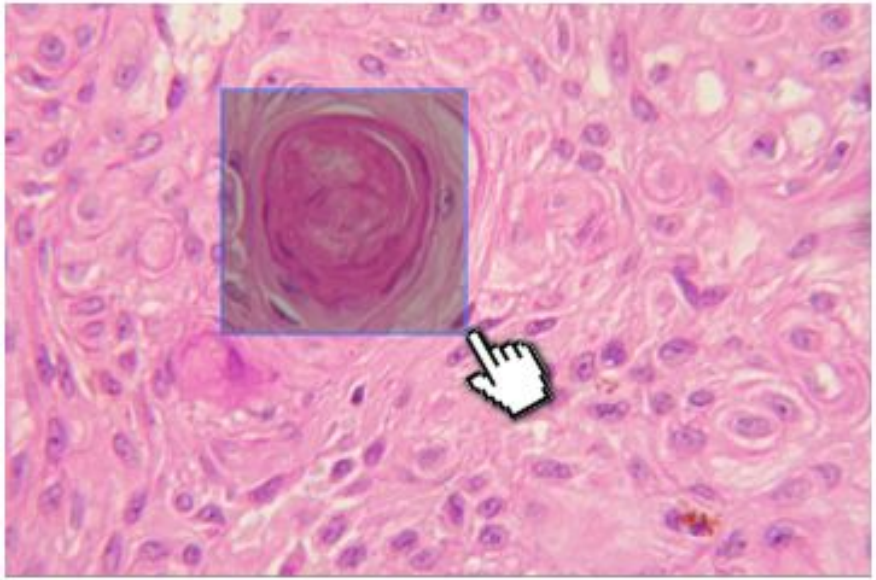
Locate the Keratin Pearl



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▼ Features	▼ Figures
Keratin Pearl	☑
duplicate cells	☐
Loss of polarity	☑
mitosis	☐
Drop ReteRidge	☐

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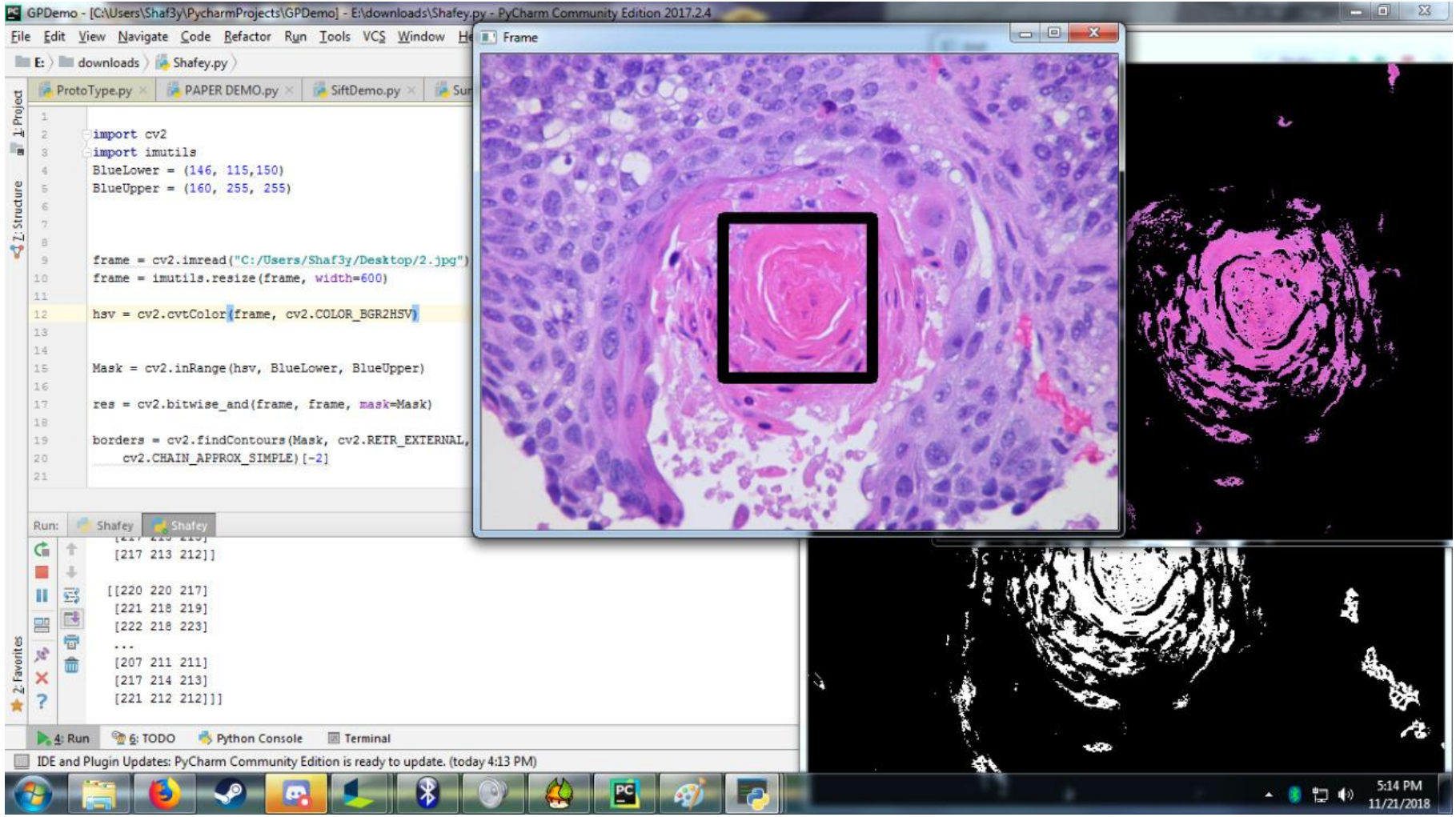
Demo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File Edit View Navigate Code Refactor Run Tools VCS Window
E: downloads Shafey.py
ProtoType.py PAPER DEMO.py SiftDemo.py
1: Project
7: Structure
2: Favorites
import cv2
import imutils
BlueLower = (146, 115,150)
BlueUpper = (160, 255, 255)
frame = cv2.imread("C:/Users/Shaf3y/Desktop/2.jpg")
frame = imutils.resize(frame, width=600)
hsv = cv2.cvtColor(frame, cv2.COLOR_BGR2HSV)
Mask = cv2.inRange(hsv, BlueLower, BlueUpper)
res = cv2.bitwise_and(frame, frame, mask=Mask)
borders = cv2.findContours(Mask, cv2.RETR_EXTERNAL,
cv2.CHAIN_APPROX_SIMPLE)[-2]
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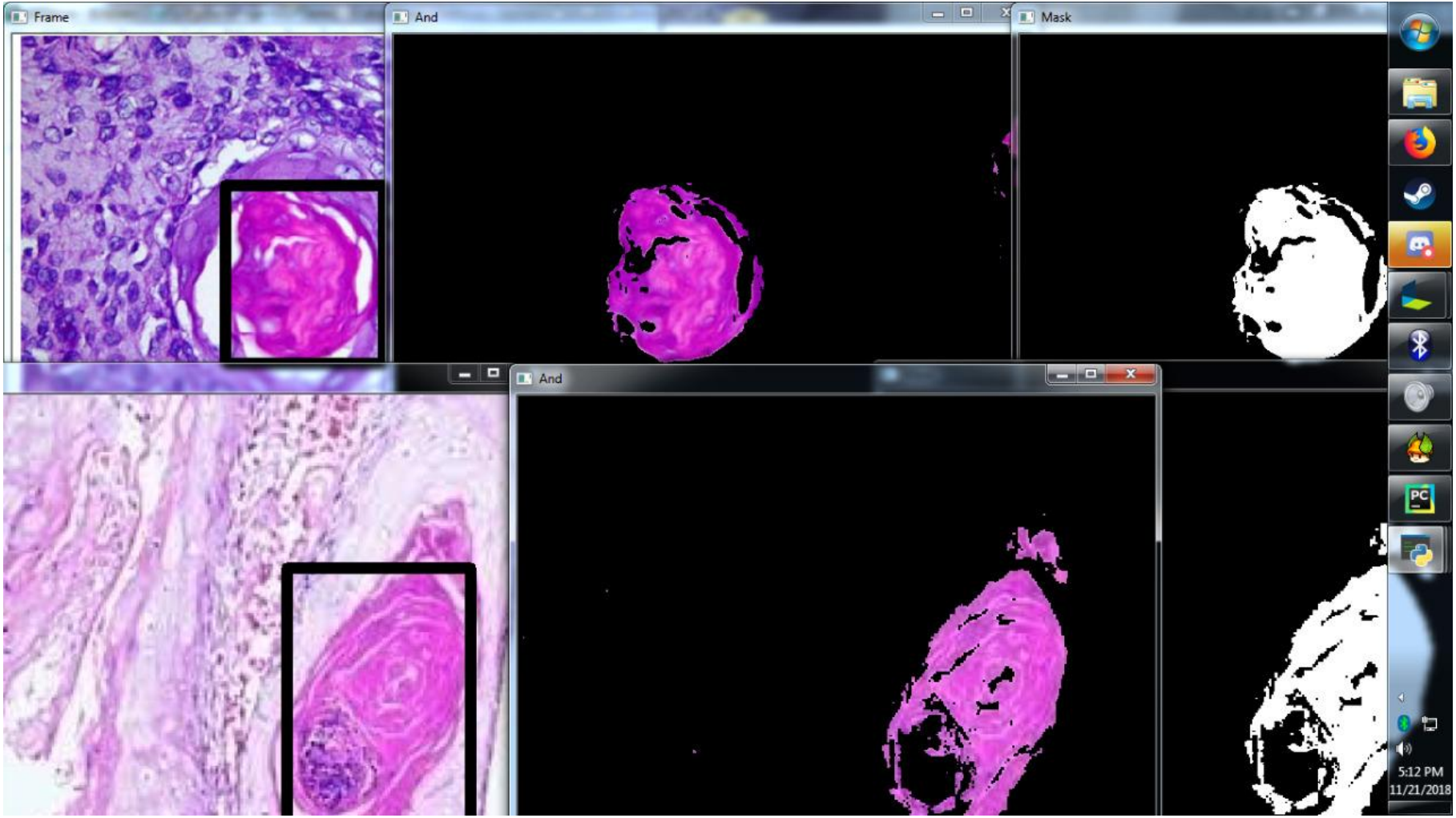
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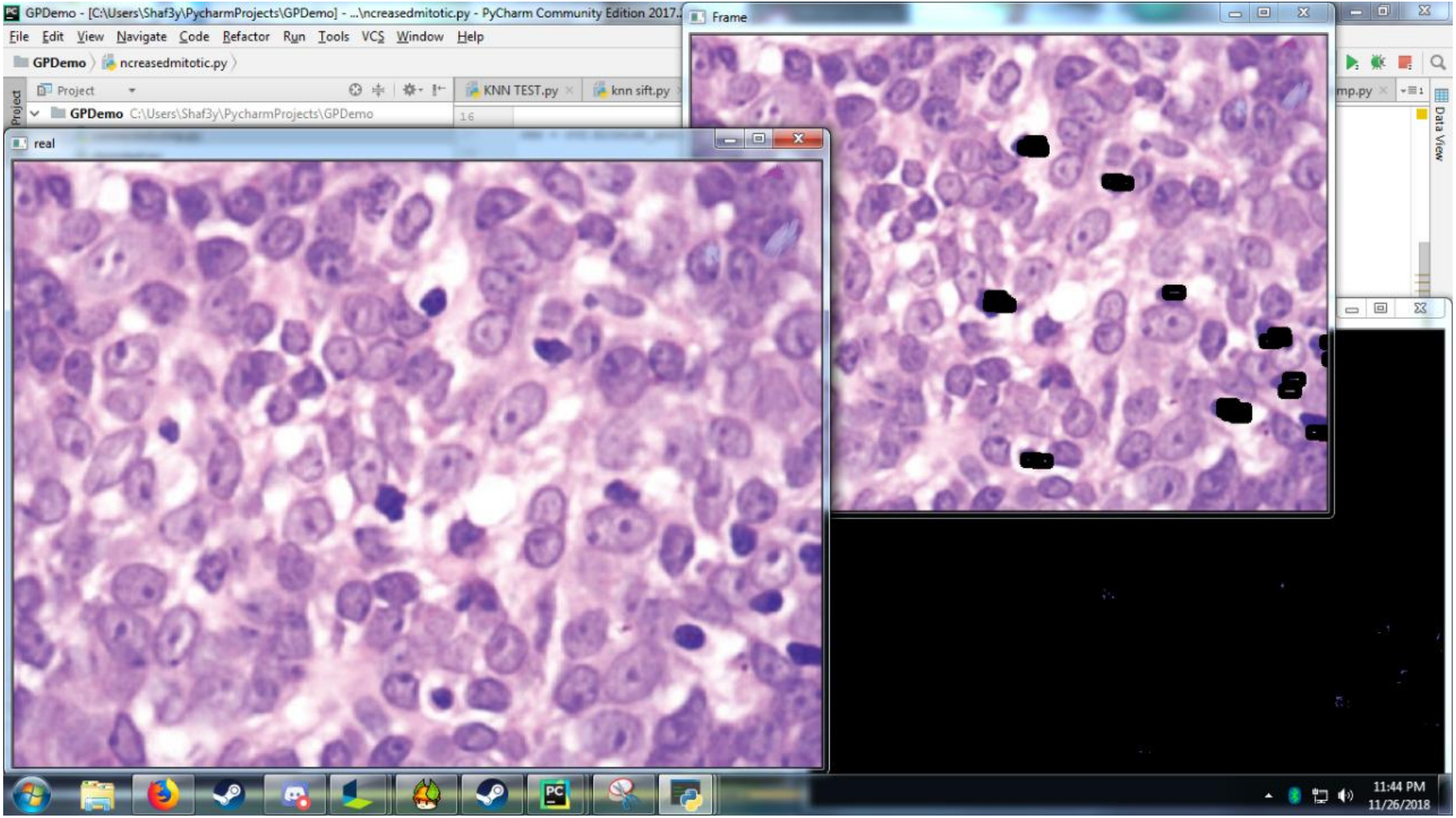
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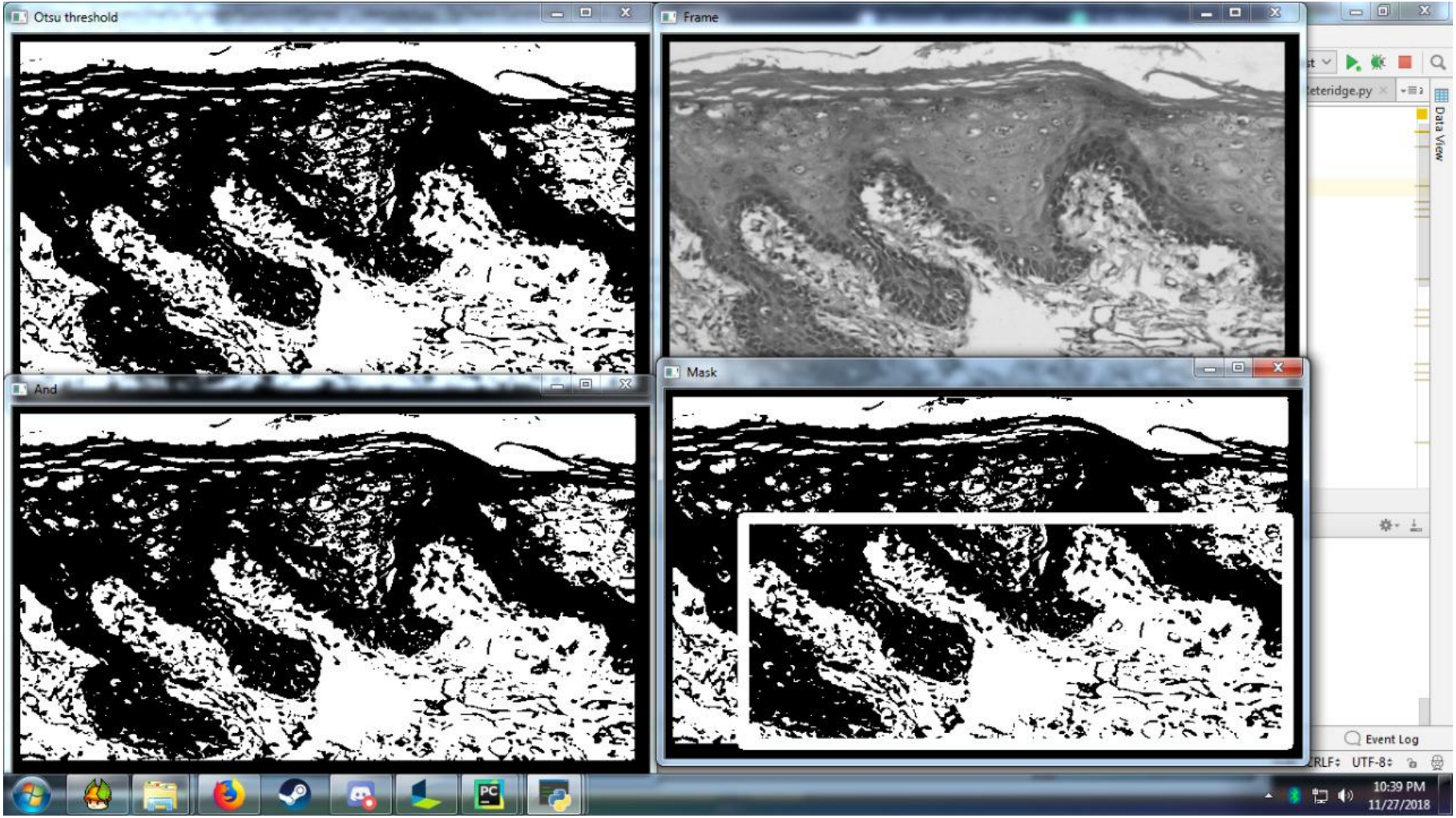
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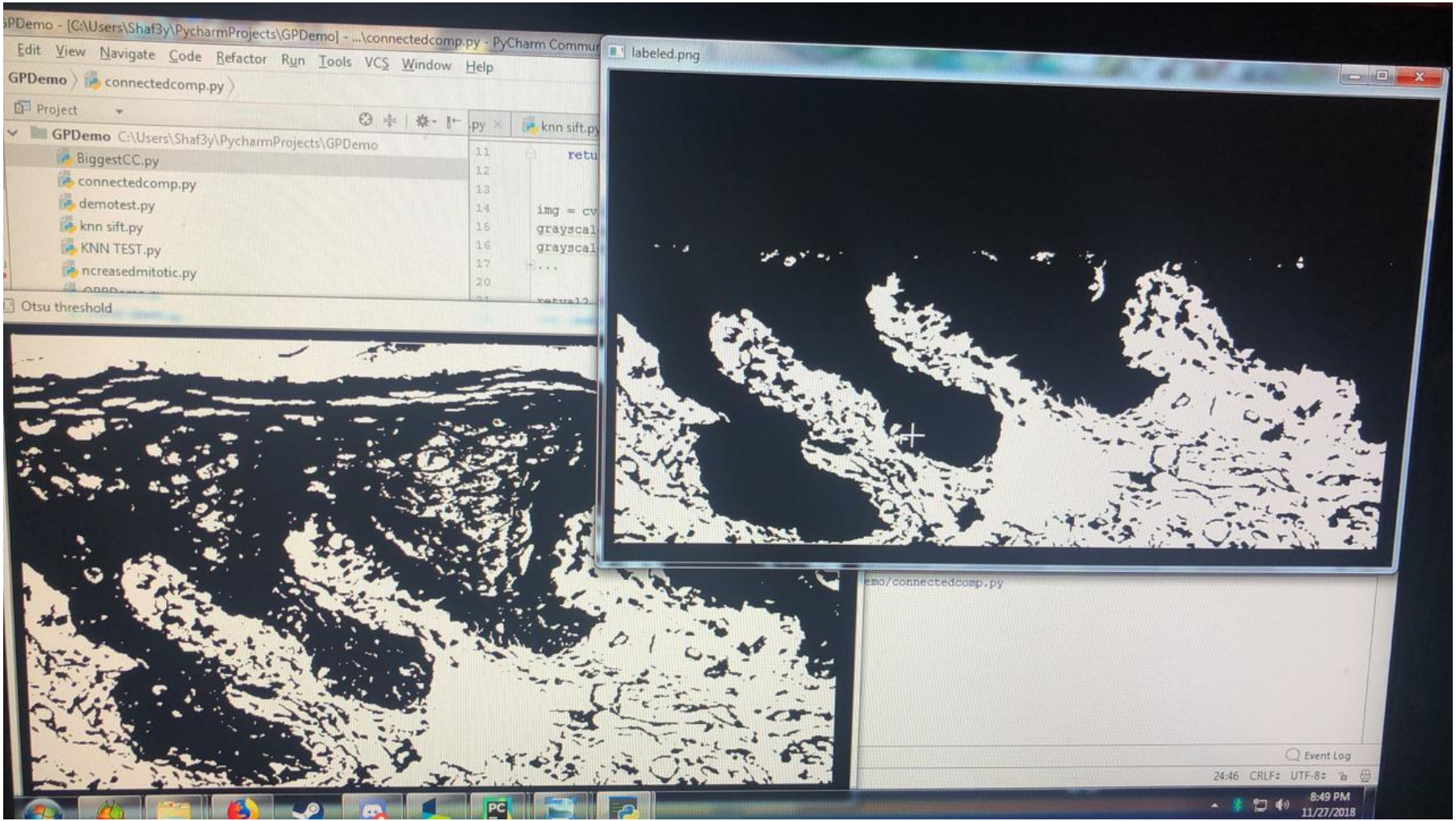
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connectedcomp.py
demotest.py
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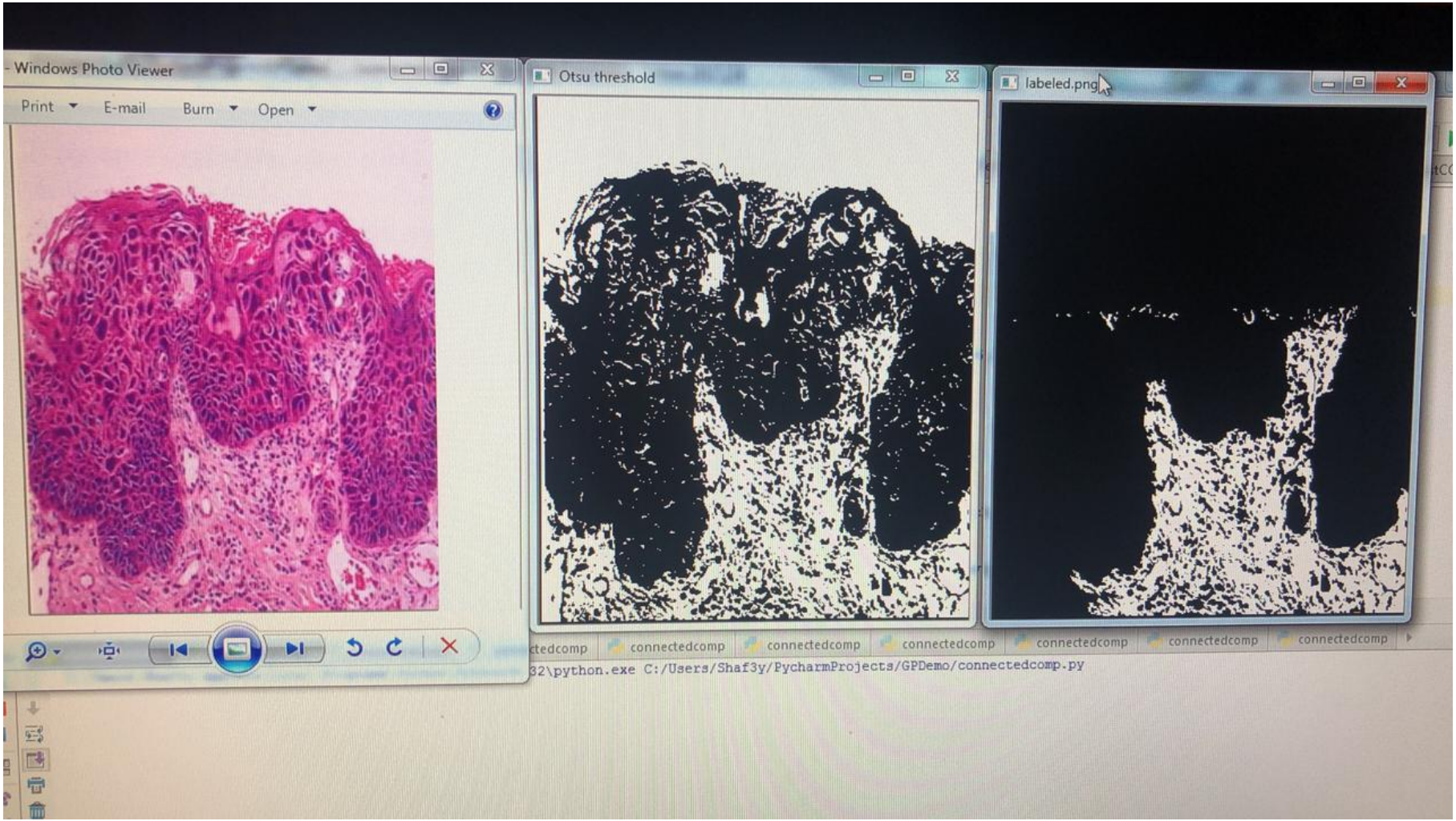
11/27/2018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Stockholder Reference

Recommendation letter

Inbox ×

hazem Abd elazim Tue, Nov 27, 8:40 PM (4 hours ago)

to me

Dear sir,

Greetings for the day. In view of the fact that digital pathology is considered a scientific revolution all over the world; and regarding its ability to provide unbiased, rapid and accurate help for the pathologists. I would like to declare the importance of the project of "Epithelial Dysplasia system" in this concern. Provisionally, this system opens a new window for applying digital pathology to detect and classify the epithelial dysplasia, that meets the market needs and shows a great expectations to solve some of the equivocal problems facing the pathological medical field. I'm fully supporting this promising system until it comes to the light.

Sincerely yours,

Hazem Abdelazim, MBBCh, MSc.
A.Lecturer of Pathology,
National Cancer Institute - Cairo university.
Specialist of Pathology,
Children Cancer Hospital - Egypt (57357).

Contribution paper status

The Contribution paper is accepted in the 13th **IEEE International Conference on Computer Engineering and Systems (ICCES 2018)**