October 3, 2018

Detection and classification of Epithelial Dysplasia
خلل الانسجة في الغشاء المخاطي

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(Computer Science Senior Students)

Supervised by **Dr. Ashraf Abdelraouf** and Eng Noha El Masry

Agenda

- Introduction
- Related Work
- Problem Statement
- System Overview
- Expected Results
- Demo

Introduction

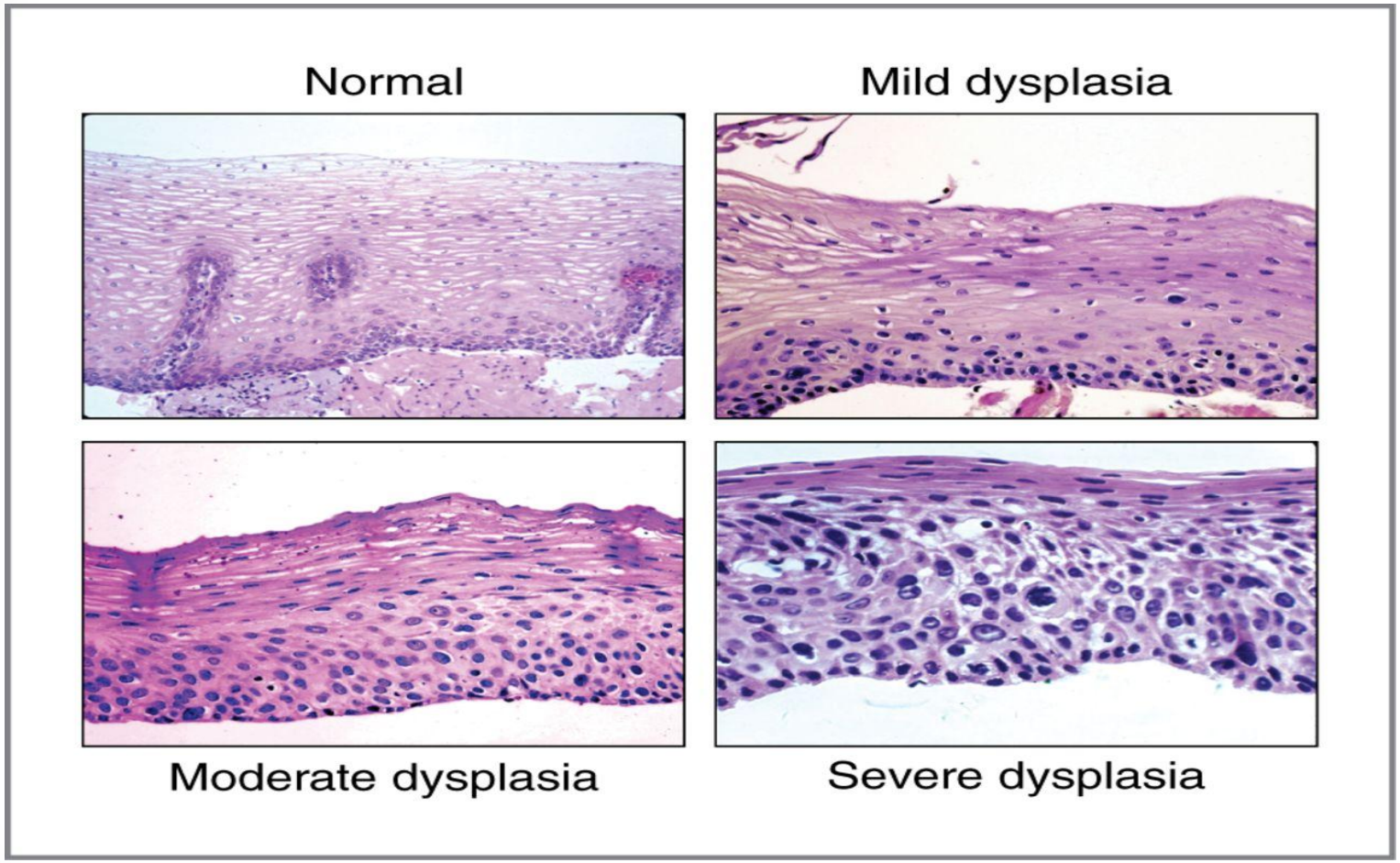
- Early diagnosis is 90% of the treatment.[1]
- Smoking, alcohol.. are the major risk factors for oral cavity cancer. [2]
- About 5-18% of epithelial dysplasia become malignant(cancerous).[3]

[1] "Why is early diagnosis important?," *Stages | Mesothelioma | Cancer Research UK*, 23-Aug-2018. [Online]. Available: https://www.cancerresearchuk.org/about-cancer/cancer-symptoms/why-is-early-diagnosis-important.

[2] L. A. Torre, F. Bray, R. L. Siegel, J. Ferlay, J. Lortet-Tieulent, and A. Jemal,"Global cancer statistics, 2012,"CA: a cancer journal for clinicians, vol. 65,no. 2, pp. 87–108,2015.

[3] "Premalignant Lesions," *The Oral Cancer Foundation*. [Online]. Available: https://oralcancerfoundation.org/cdc/premalignant-lesions/.

Introduction - Categories

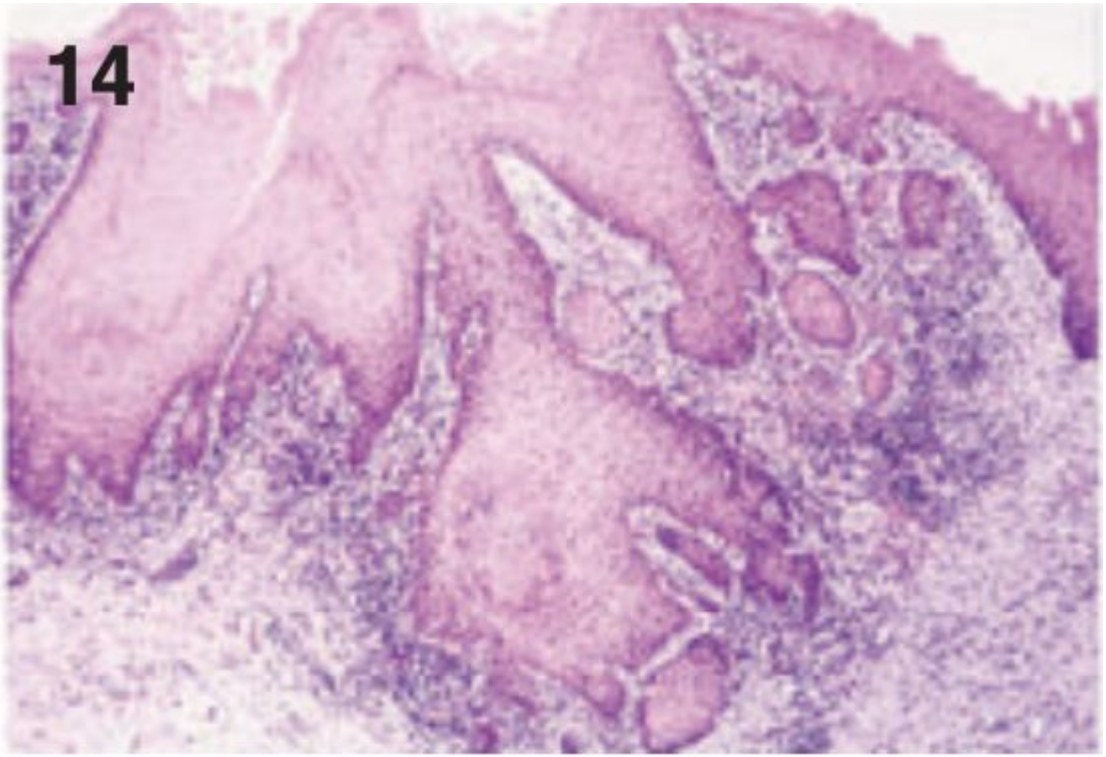


[1]"Oral Soft-Tissue Biopsy: An Overview," *Managing Patients With Necrotizing Ulcerative Periodontitis | jcda*. [Online]. Available: http://www.jcda.ca/article/c75.

[2]Kert Edward, Suimin Qiu, Vicente Resto, Susan McCammon, Gracie Vargas, "layer-resolved characterization of oral dysplasia via nonlinear optical micro-spectroscopy," Biomed. Opt. Express 3, 1579-1593 (2012);

Categories - Cont.

Invasive Cancer



Input Images

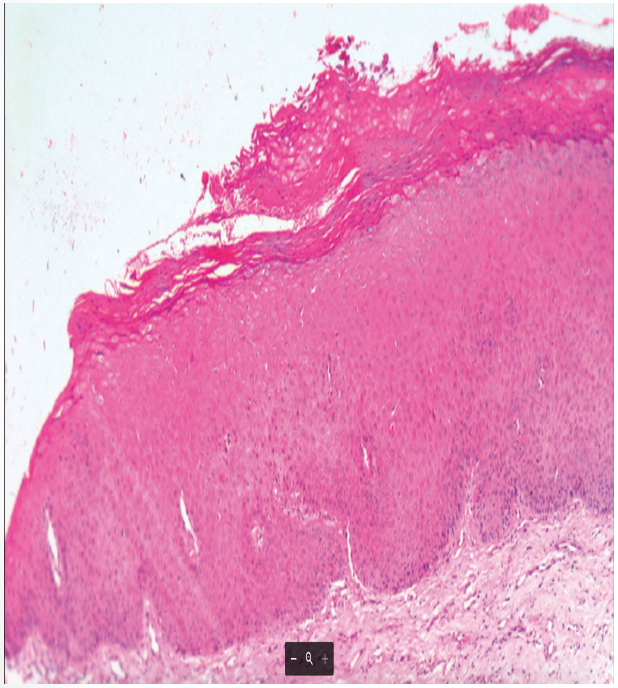


Fig. 1: 40x Image

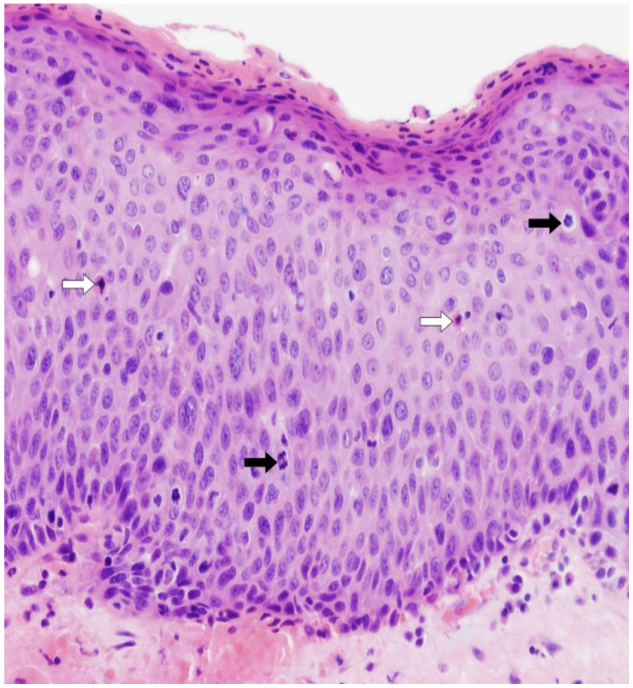


Fig. 2: 100x Image

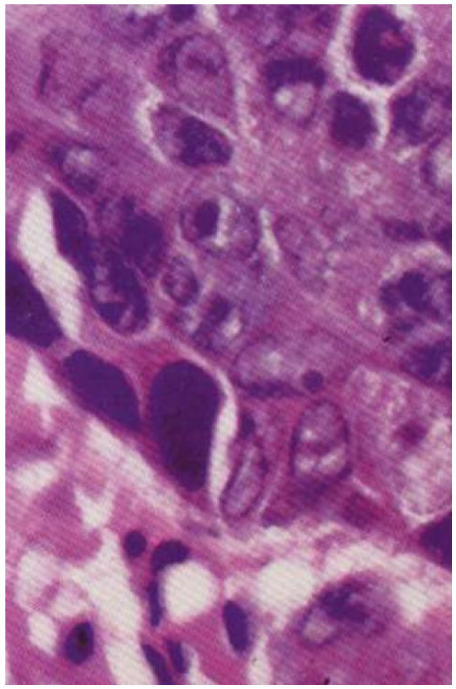


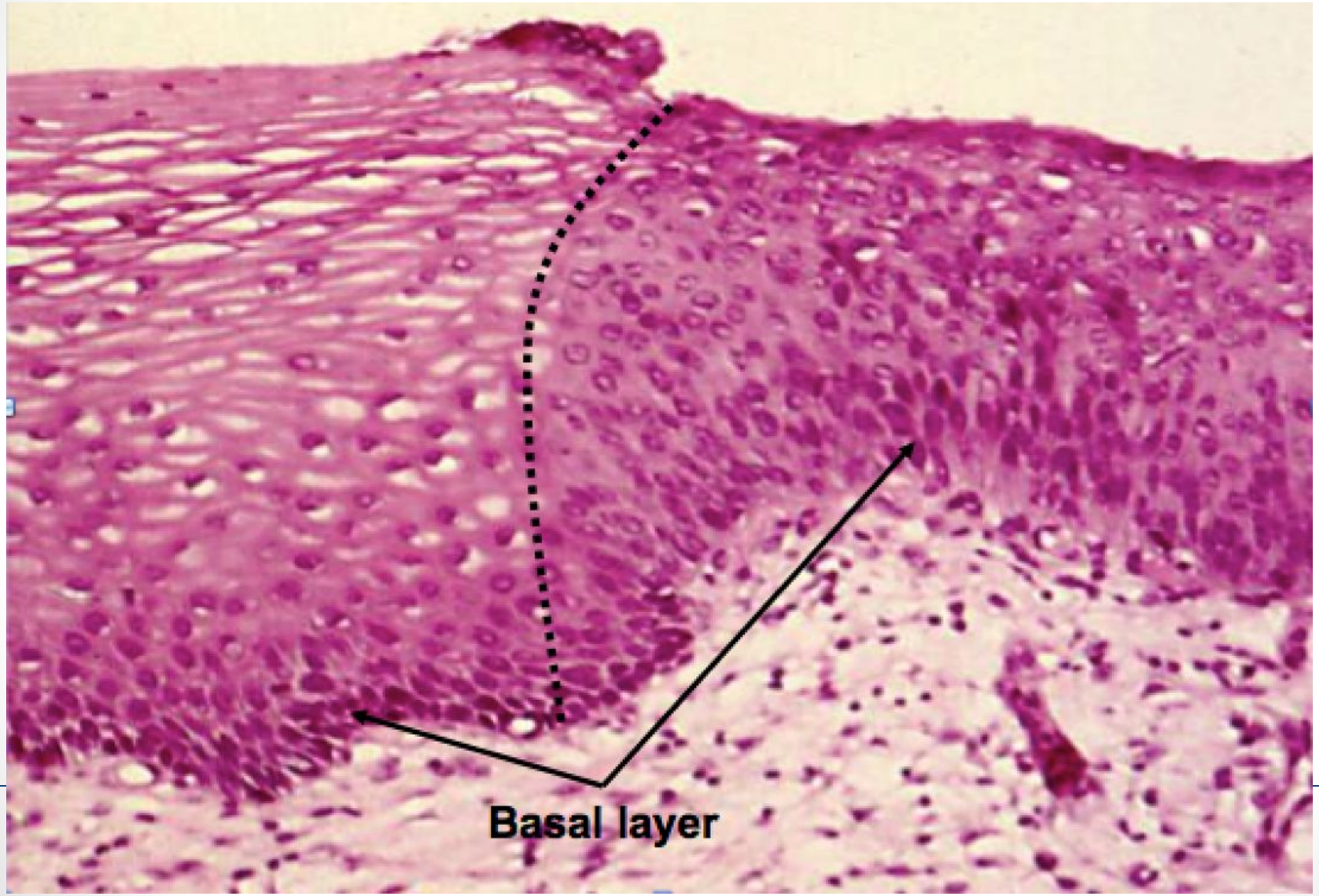
Fig. 3: 400x Image

Criterias

Architecture	Cytology
Irregular epithelial stratification	Abnormal variation in nuclear size (anisonucleosis)
Loss of polarity of basal cells	Abnormal variation in nuclear shape (nuclear pleomorphism)
Basel cell hyperplasia	Abnormal variation in cell size (anisocytosis)
Drop-shaped rete ridges	Abnormal variation in cell shape (cellular pleomorphism)
Increased number of mitotic figures	Increased nuclear-cytoplasmic ratio
Abnormally superficial mitoses	Increased nuclear size
Pre-mature keratinization in single cells (dyskeratosis)	Atypical mitotic figures
Keratin pearls within rete ridges	Increased number and size of nucleoli
	Hyperchromasia

R. K. D. Reetoja Naga, “Analysis of images for detection of oral epithelial dysplasia,” 2018.

Loss of polarity



Drop shaped rete ridges

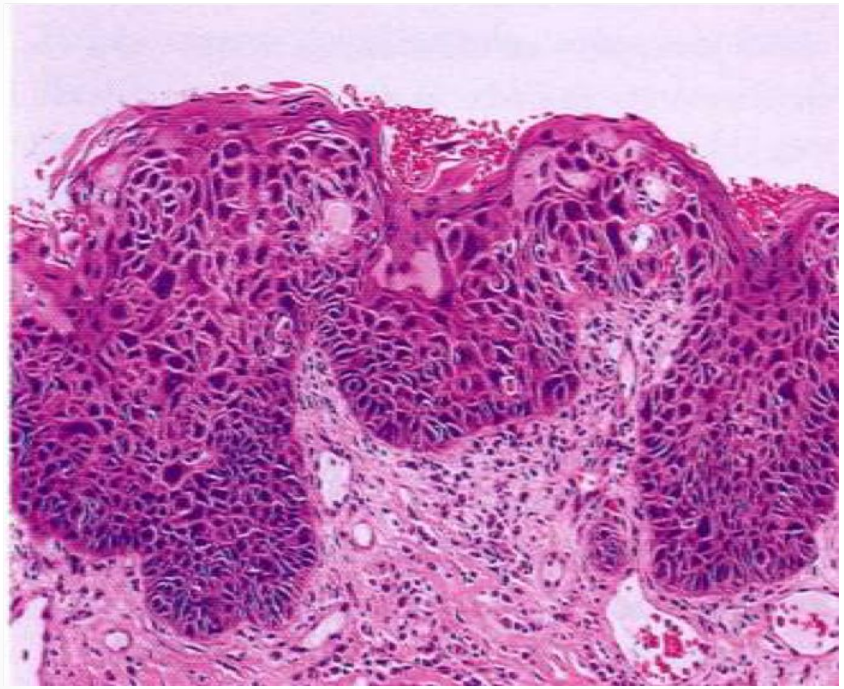


Fig. 1: Dropped Rete Ridges

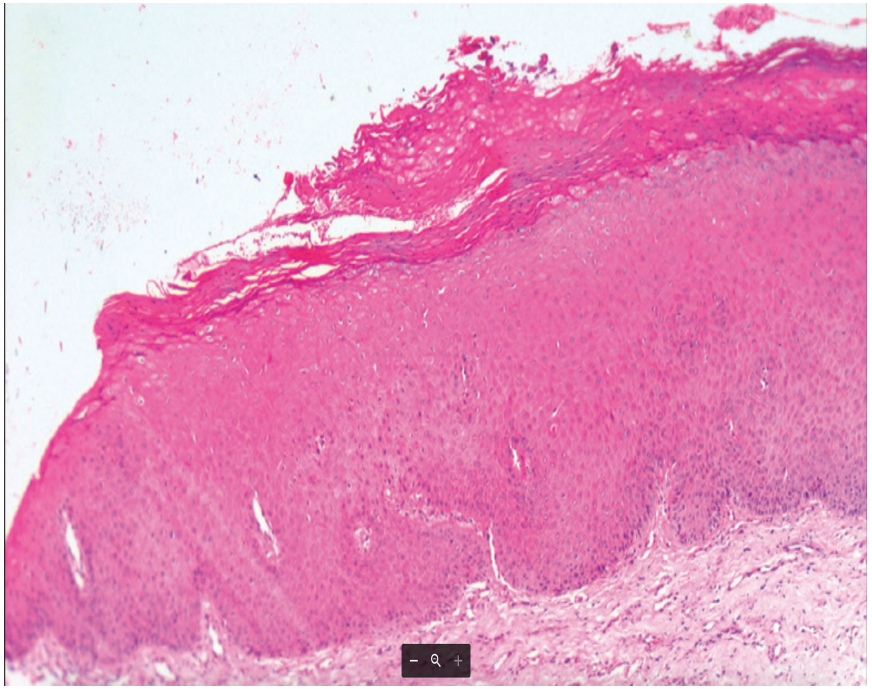
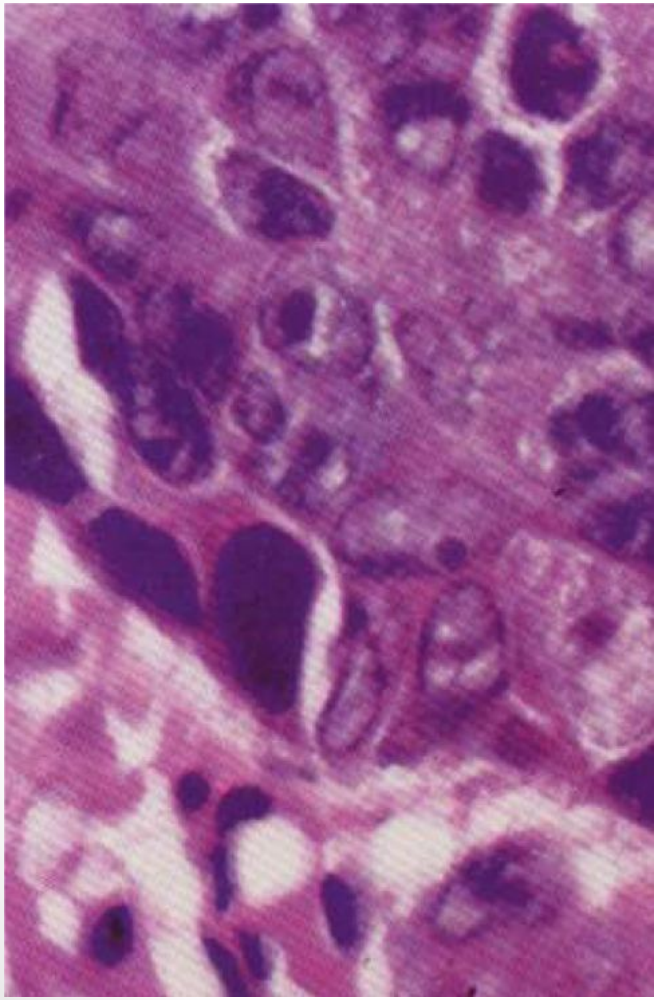
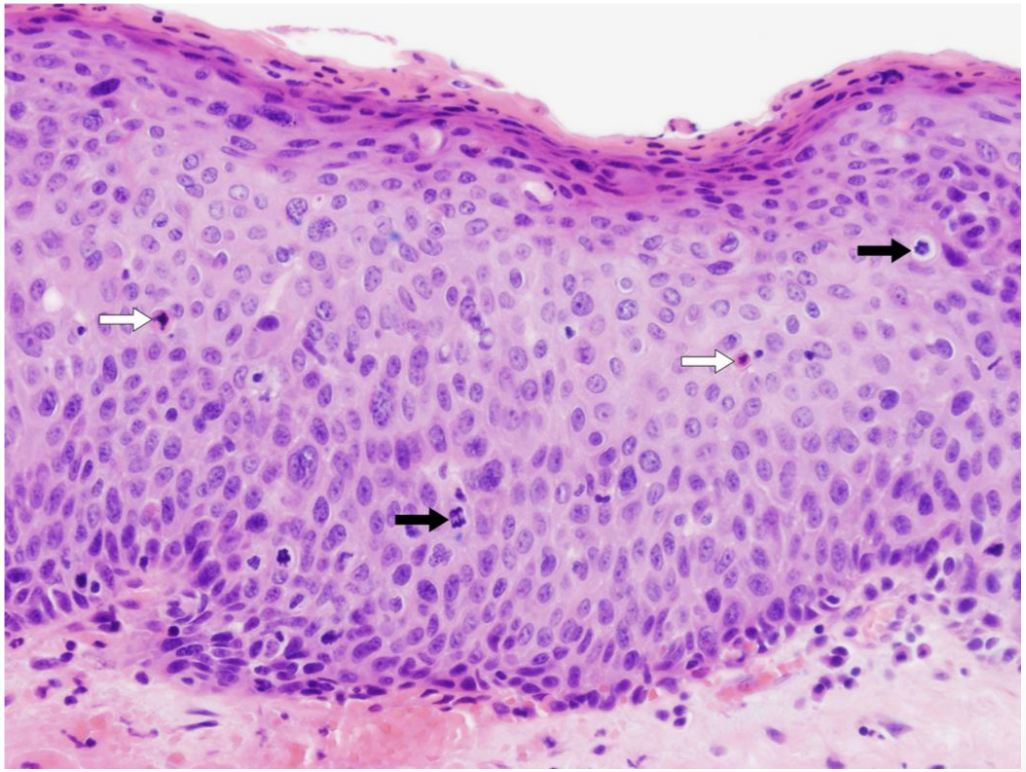


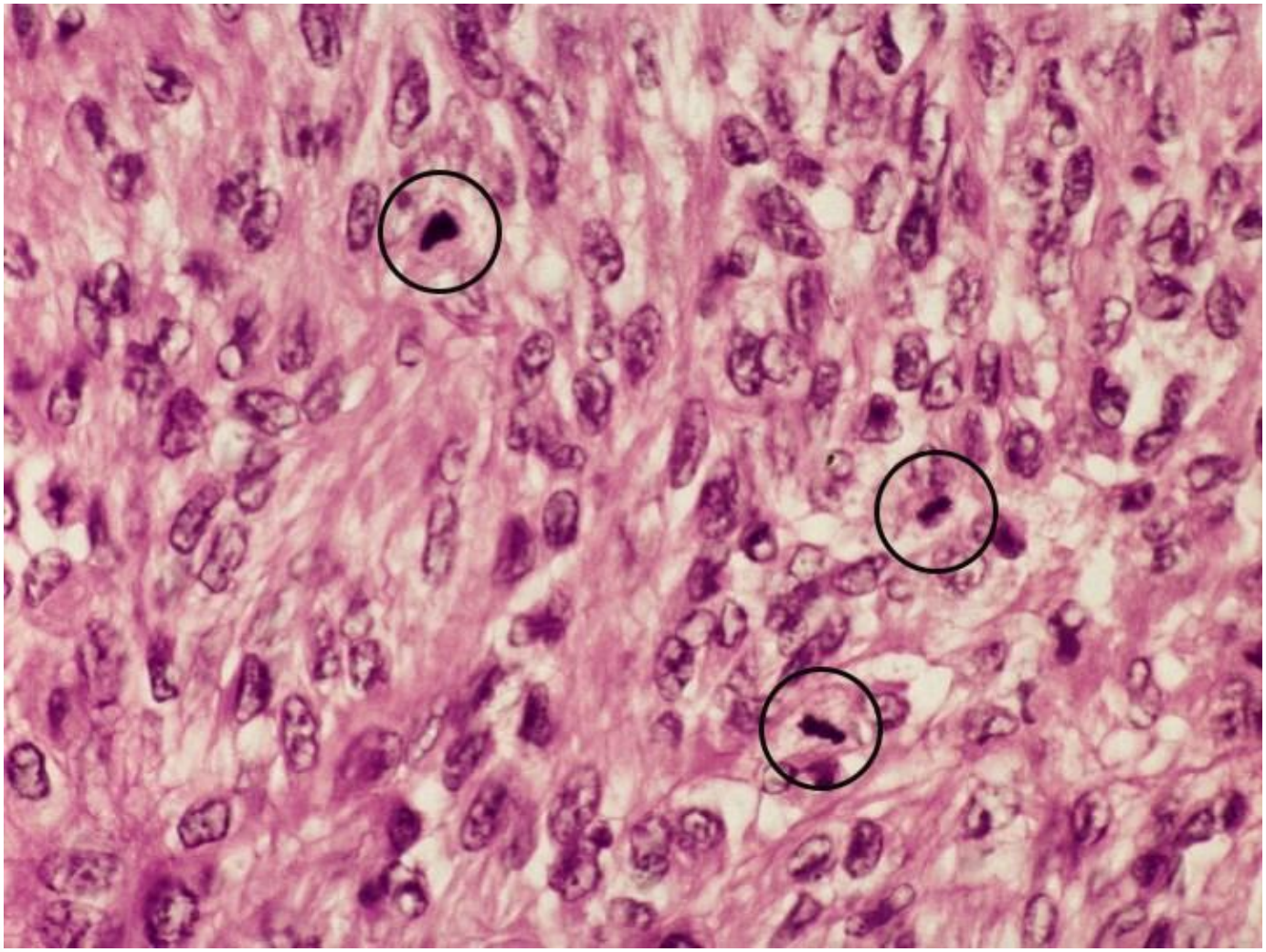
Fig. 2: Normal Rete Ridges

Mitotic figures and abnormal nucleus architecture

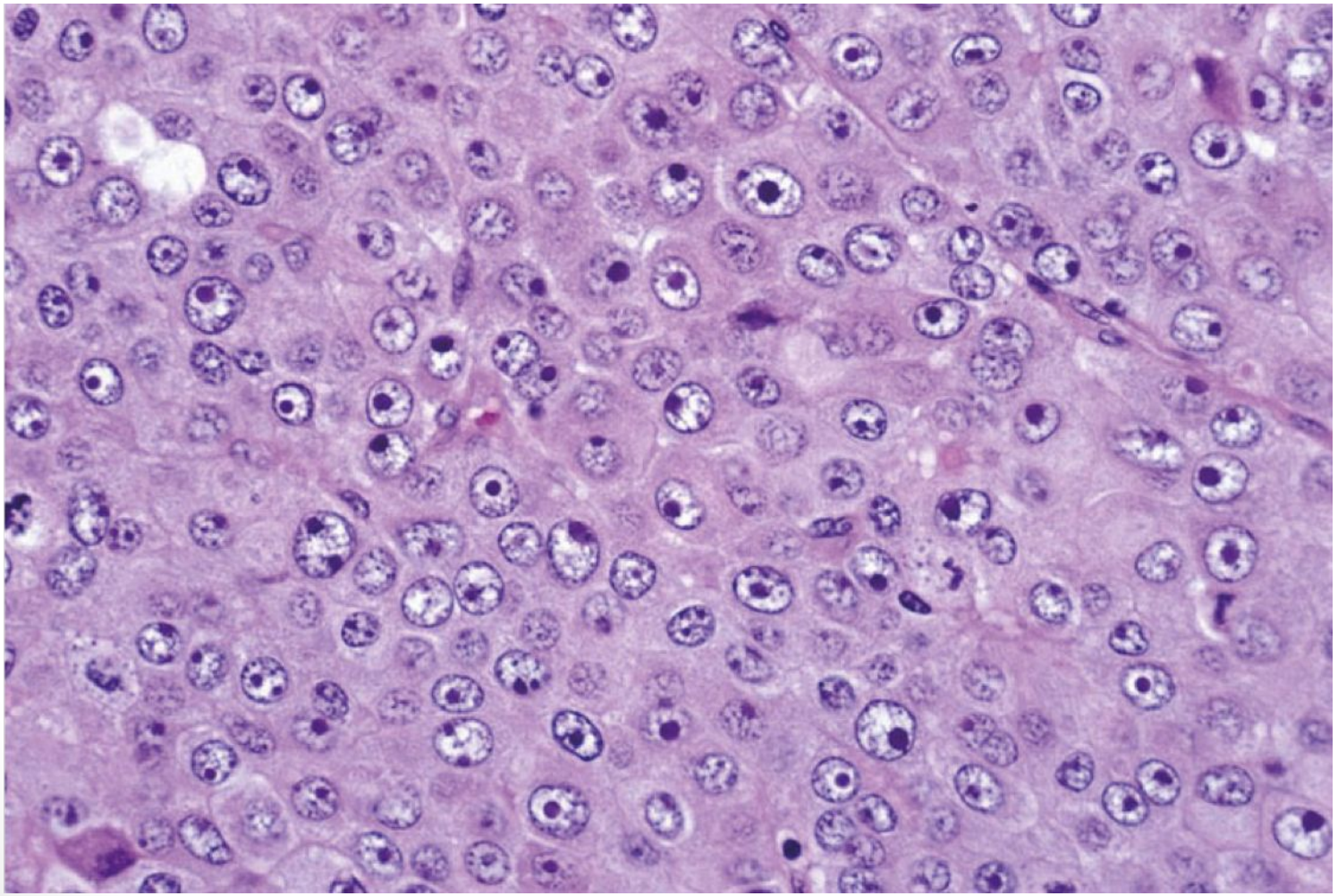




Mitotic figure



Increased number and size in nucleoli



Binary System Classification

Low Grade (Mild, Moderate)

- Less than FOUR architectural changes.
- Less than FIVE cytological changes.

High Grade (Carcinoma In-Situ)

- More than FOUR architectural changes.
- More than FIVE cytological changes.

Barnes, Leon, et al. *World Health Organization Classification of Tumours: Pathology and Genetics of Head and Neck Tumours*. IARC Publications, 2005.

WHO Classification

Mild: Slight nuclear abnormalities, the cells show maturation and stratification involving the one-third of the epithelium.

Moderate: More nuclear abnormalities and nucleoli tend to be present mostly in the basal two-third of the epithelium.

Carcinoma In-Situ: Even More nuclear abnormalities and loss of maturation involve more than two-third of the epithelium. Mitoses some of which are abnormal.

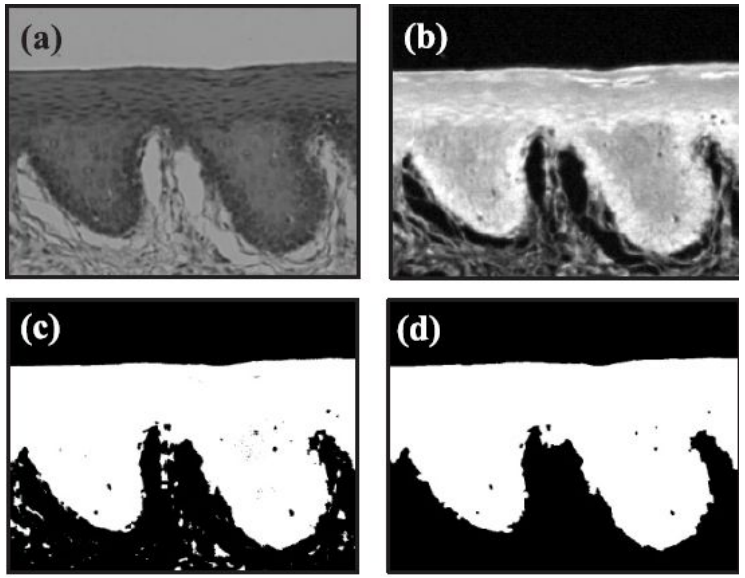
Geetha, KM, et al. Current Neurology and Neuroscience Reports., U.S. National Library of Medicine, 2015, www.ncbi.nlm.nih.gov/pmc/articles/PMC4611929/s

Related Work - 1

A Computer-Aided Distinction Method of Borderline Grade of Oral Cancer

Techniques:

(a) Twins Pair ROI
(b) Adjusted Saturation
(c) Morphed Image
(d) Largest Region
- Roundness Calculation



Challenges:

- Epithelium Segmentation due to **staining artifacts** and **lighting acquisition conditions**.

S. M. S. M. H. K. T. S. Mustafa M. Sami, Masahisa SAITO,
A Computer-Aided Distinction Method of Borderline Grade of Oral Cancer,
2018

Related Work - 2

SVM BASED CLASSIFICATION OF EPITHELIAL DYSPLASIA USING SURF AND SIFT FEATURES

Techniques:

- HSV, Gaussian Filter - Preprocessing
- SURF Feature Extraction
- SIFT Feature Extraction
- Support Vector Machines

Results:

- **91.4%** Success Rate using SURF
- **84.18%** Success Rate using SIFT

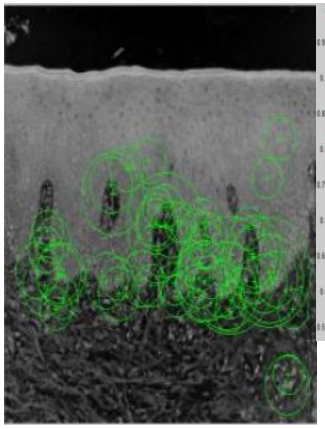


Fig. 1: SURF Feature Extraction

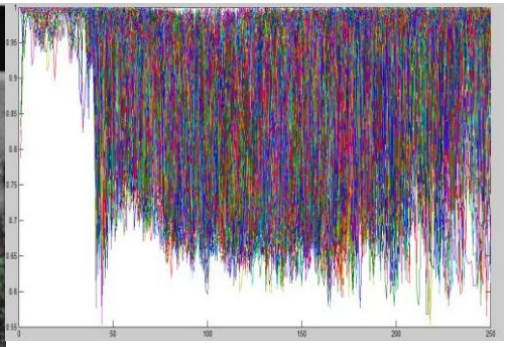


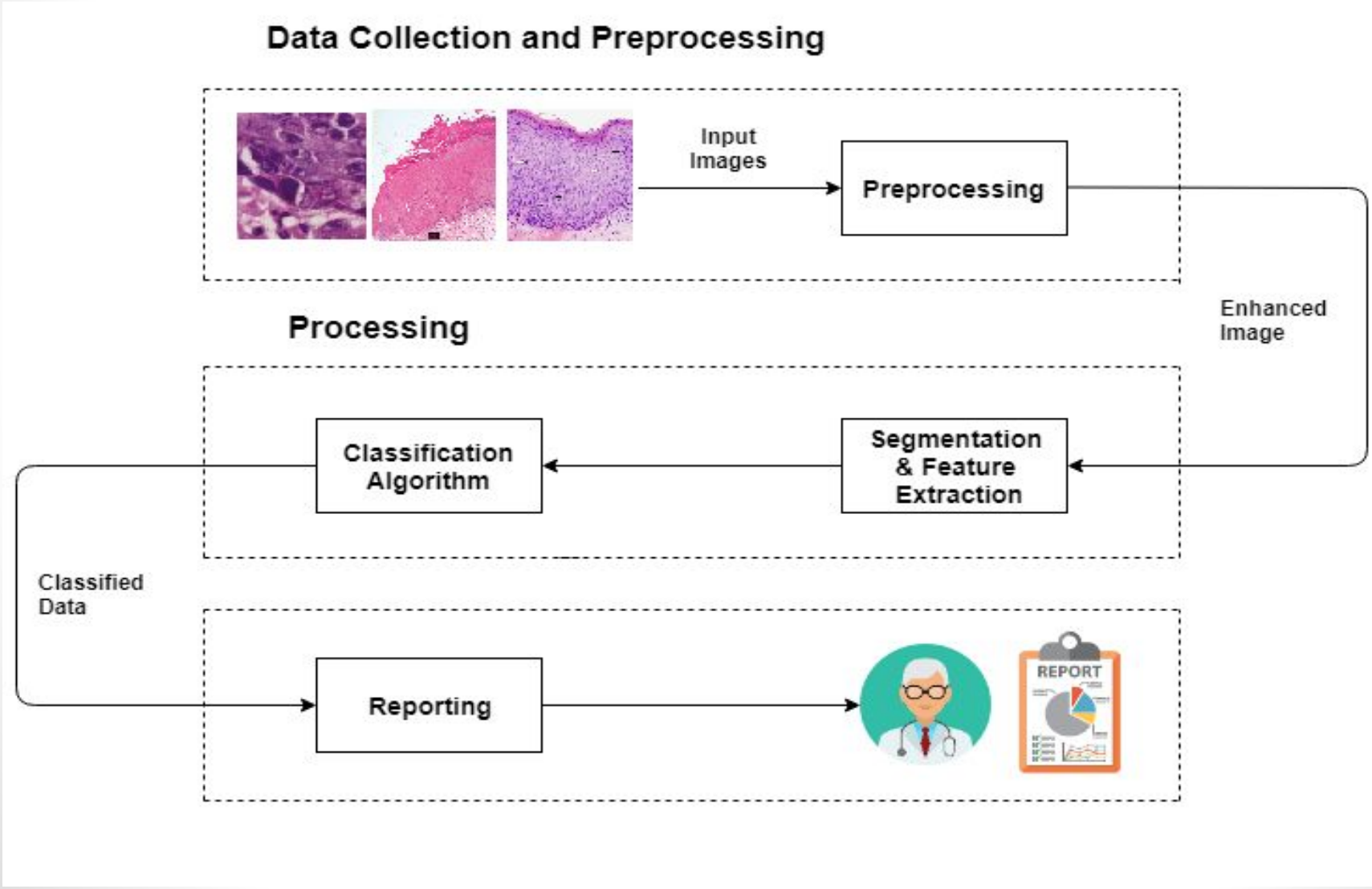
Fig. 2: SIFT Feature Extraction

P.Aurchana, Dr.P.Dhanalakshmi, Research Scholar, Associate Professor, Annamalai University, Annamalai University, Chidambaram, SVM Based Classification of Epithelial Dysplasia Using SURF and SIFT Features, 2017

Problem Statement

Detection and Improvement in the classification ACCURACY of the abnormality of the epithelial along with detailed REPORTED ANALYSIS.

System Overview



System Overview - Classifiers

- Use SVM classifier[1]
- Use RCNN Classifier[2]
- Combinations between classifiers.

[1]S. K. B. C. C. R. R. P. J. C. A. K. R. M. Muthu Rama Krishnan, Mousumi Pal, “Automated classification of cells in sub-epithelial connective tissue of oral sub-mucous fibrosis-an svm based approach,” 2009.
[2]L. L. Z. W. L. K. . E. B. T. B. S. N. P. Jiamin Liu, David Wang and R. M. Summers, “Detection and diagnosis of colitis on computed tomography using deep convolutional neural networks,” 2017.

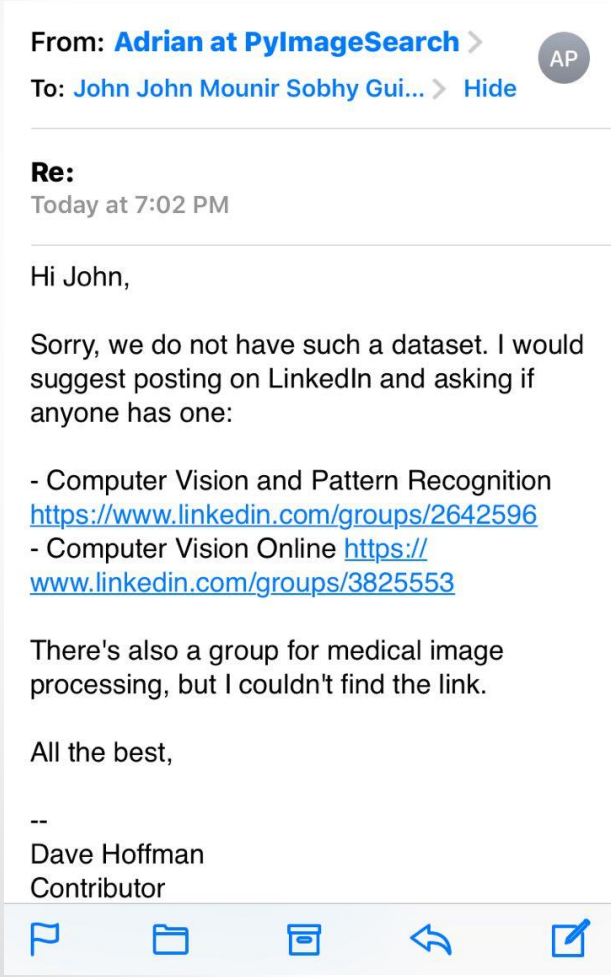
Expected Results

- Output images with detected dysplasia criteria.
- Output dysplasia dense level
  (Normal, Mild, Moderate, Severe (Carcinoma in-situ), Invasive Cancer, etc.).
- Reported analysis to the image with detailed information of the patient.

Demo

Any Questions ?

Supportive Documents



From: Adrian at PyImageSearch
To: John John Mounir Sobhy Gui... Hide

Re:
Today at 7:02 PM

Hi John,

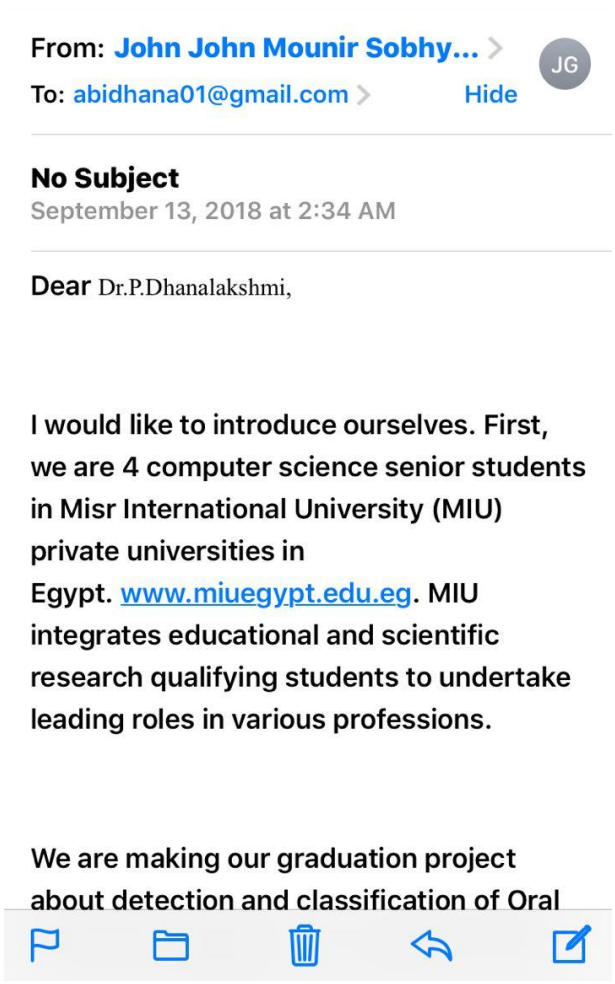
Sorry, we do not have such a dataset. I would suggest posting on LinkedIn and asking if anyone has one:

- Computer Vision and Pattern Recognition https://www.linkedin.com/groups/2642596
- Computer Vision Online https://www.linkedin.com/groups/3825553

There's also a group for medical image processing, but I couldn't find the link.

All the best,

--
Dave Hoffman
Contributor



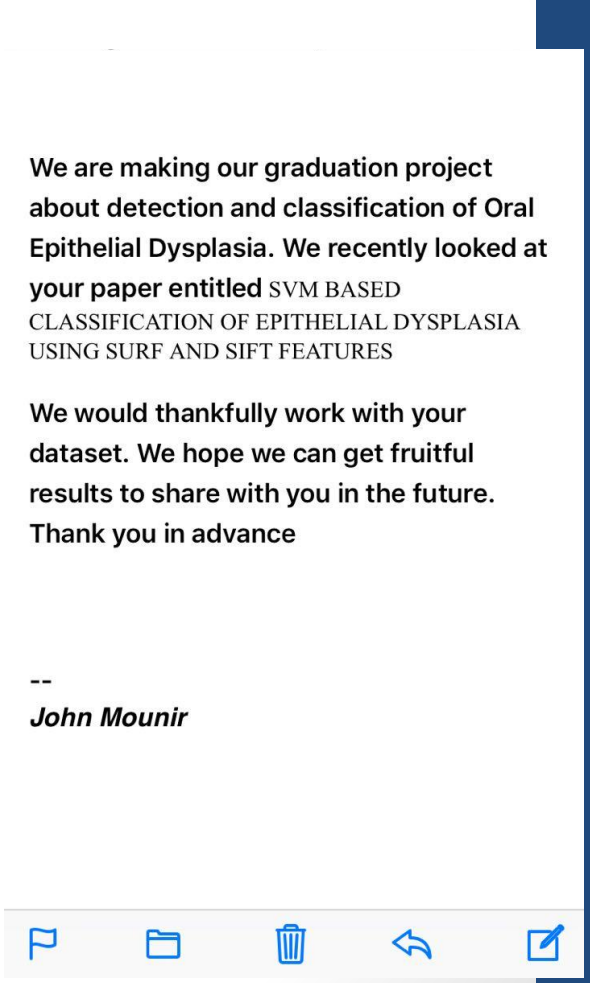
From: John John Mounir Sobhy...
To: abidhana01@gmail.com Hide

No Subject
September 13, 2018 at 2:34 AM

Dear Dr.P.Dhanalakshmi,

I would like to introduce ourselves. First, we are 4 computer science senior students in Misr International University (MIU) private universities in Egypt. www.miuegypt.edu.eg. MIU integrates educational and scientific research qualifying students to undertake leading roles in various professions.

We are making our graduation project about detection and classification of Oral



We are making our graduation project about detection and classification of Oral Epithelial Dysplasia. We recently looked at your paper entitled SVM BASED CLASSIFICATION OF EPITHELIAL DYSPLASIA USING SURF AND SIFT FEATURES

We would thankfully work with your dataset. We hope we can get fruitful results to share with you in the future. Thank you in advance

--
John Mounir

Supportive Documents

From: John John Mounir Sobhy... JG

To: aurchana85@gmail.com Hide

No Subject

September 13, 2018 at 2:33 AM

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Supportive Documents