# Machine Vision Applications

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# Application Areas

1. Facial Expression Analysis
2. Medical Assistive Systems
3. Multi-Instance, Multi-View and Multi-Label Object Recognition

# Facial Expression Analysis

# Facial Emotional Expression Recognition: What?

**Facial Emotional Expression**

Anger, Disgust, Fear, Joy, Sadness, and Surprise are six basic facial expressions *

**Facial Emotional Expression Recognition**

Mechanism to identify facial expressions through computing algorithms


Anger


Disgust


Fear


Joy


Sad


Surprise

*Charles Darwin, "The Expression of the Emotions in Man and Animals," *Anniversary ed., P. Ekman, Ed. Harper Perennial, 1872/2009*

# Facial Emotional Expression Recognition: Why ?

## Social Aspect

- Aiding autistic patients
- Aiding psychologists to help in analyzing their patient's condition, like in depression/schizophrenia
- Deception detection in criminology

## Business Aspect

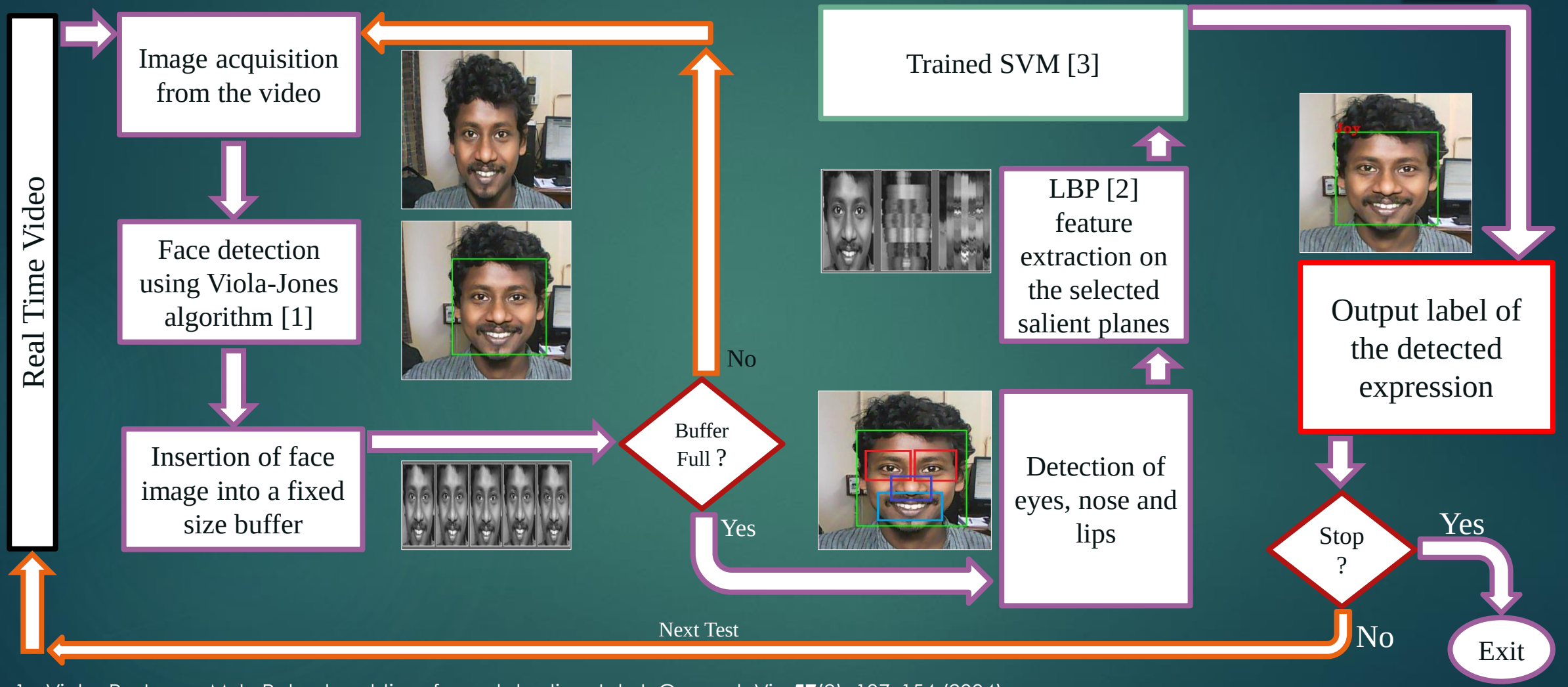
- Ad film/TV soap pre-launching, TRP
- Advertising, market/customer behavior analysis

# Recognition of Facial Expressions in Real-Time

Published Papers:

1. S. Agarwal, B. Santra, and D. P. Mukherjee, "Anubhav: recognizing emotions through facial expression," The Visual Computer, Springer, pp. 1–15, 2016.

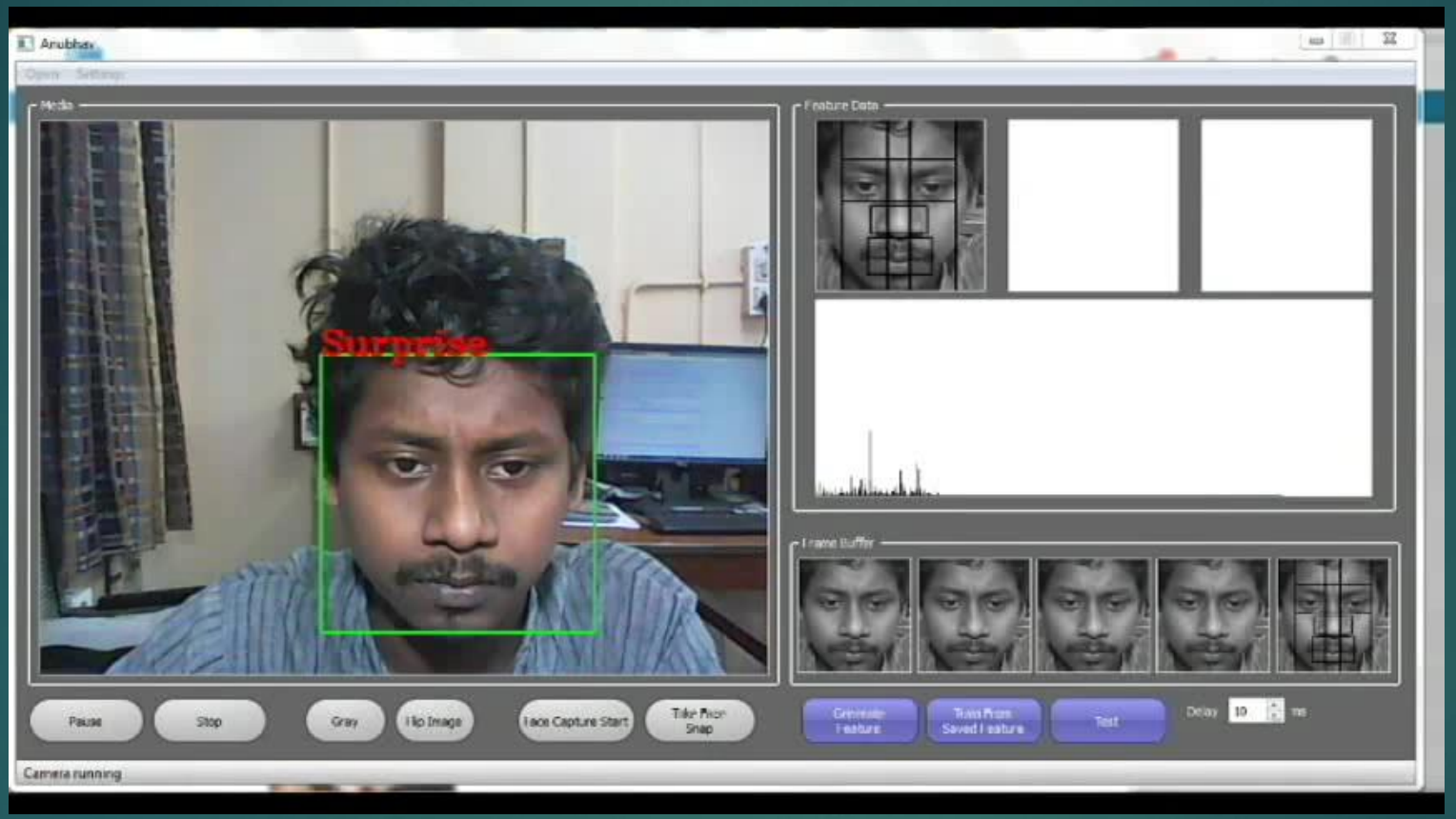
# Block Diagram of Anubhav





1. Viola, P., Jones, M.J.: Robust real-time face detection. Int. J. Comput. Vis. **57**(2), 137–154 (2004)
2. Timo Ojala, Matti Pietikainen, and Topi Maenpaa, "Multiresolution gray-scale and rotation invariant texture classification with local binary patterns," *Pattern Analysis and Machine Intelligence, IEEE Transactions on*, vol. 24, no. 7, pp. 971–987, 2002.
3. Corinna Cortes and Vladimir Vapnik, "Support-vector networks," *Machine learning*, vol. 20, no. 3, pp. 273–297, 1995.

# Anubhav: In Action




1. YouTube Link of This Demo – https://www.youtube.com/watch?v=pLq9H83Dd40
2. Android Application Download Link - https://www.dropbox.com/s/iz06a3om7xqvf3s/Anubhav.apk?dl=0

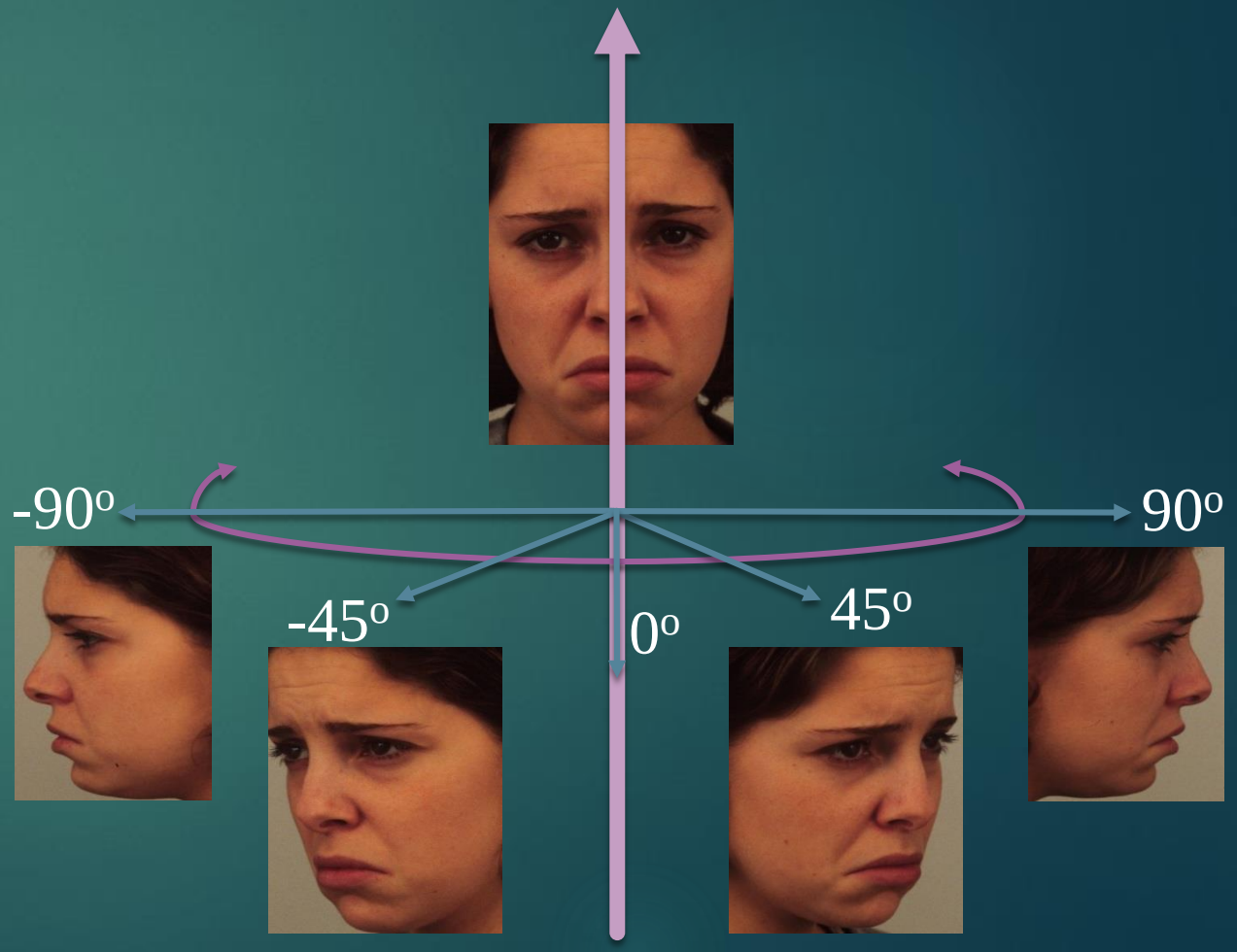
# Recognition of Multi-View Facial Expressions

Published Papers:


1. B. Santra and D. P. Mukherjee, "Local dominant binary patterns for recognition of multi-view facial expressions," in Proceedings of the Tenth Indian Conference on Computer Vision, Graphics and Image Processing (ICVGIP). ACM, 2016, p. 25.
2. B. Santra and D. P. Mukherjee, "Local saliency-inspired binary patterns for automatic recognition of multi-view facial expression," in Image Processing (ICIP), 2016 IEEE International Conference on. IEEE, 2016, pp. 624–628.

# Multi-view Facial Expressions

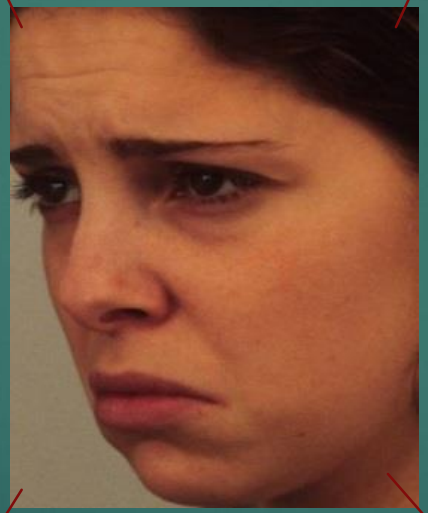
Facial expressions captured from both fronto-parallel and non-fronto-parallel cameras



# Challenges in Recognizing Multi-view Facial Expression (MVFE)

Views

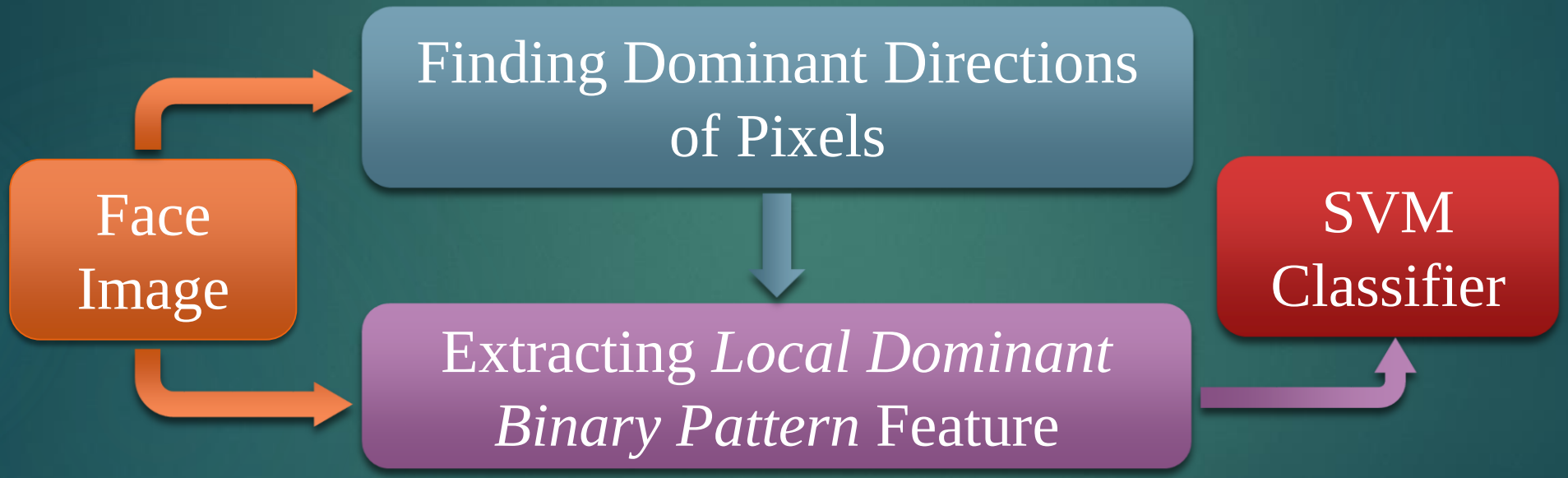
Emotions



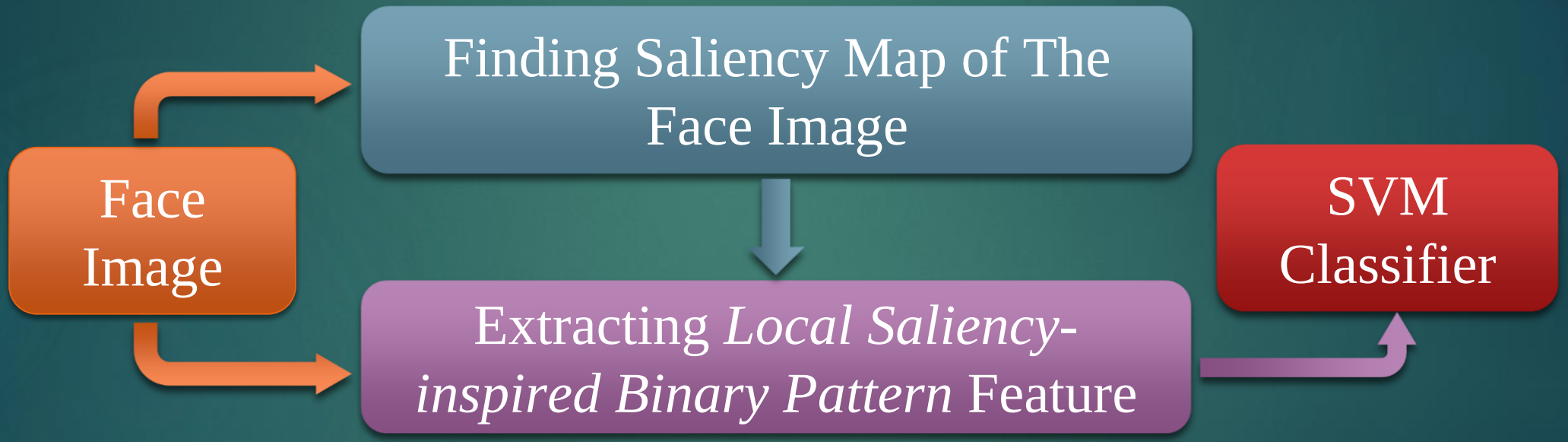
2D face image

Computationally inexpensive scheme for 2D face image

# Overview of Paper 1



# Overview of Paper 2



# Medical Assistive Systems

# Hemoglobin Estimation from Videos of Palm

Published Papers:

1. B. Santra, D. P. Mukherjee and D. Chakrabarti, "A Non-Invasive Approach for Estimation of Hemoglobin Analyzing Blood Flow in Palm," in Proceedings of the *International Symposium on Biomedical Imaging (ISBI), 2017*

# Palm Video Characteristics

Objective → To Infer Hemoglobin

Normal Palm

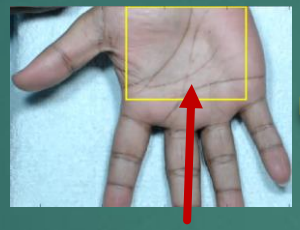
With restricted Blood Flow

After Removal of Restriction

# Process Work Flow

Data Acquisition

Salient Palm Patch Identification on Ist Frame

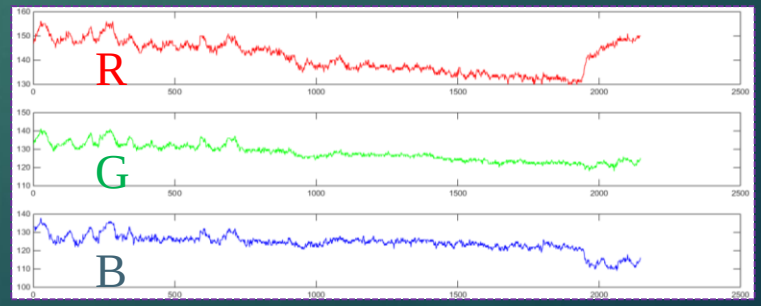


Automatic Palm Selection

Salient Patch Identification

Median of R, G, B values from Each Salient Patch of Each Frame

Extraction of Features




Quadratic Regression Model

Predicted Hemoglobin Content

# THANK YOU

*"No amount of experimentation can ever prove me right; a single experiment can prove me wrong." - Albert Einstein*