Suspicious Face Detection

in computer-based academic lab monitoring

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The Problem

- Majority of computer-based labs
- Compact Seating arrangements
- Higher manpower for monitoring
- Real-Time Detection
- Immediate Action

The Sub Problems

01 Good quality video capturing

02 Accuracy of the Detection systems

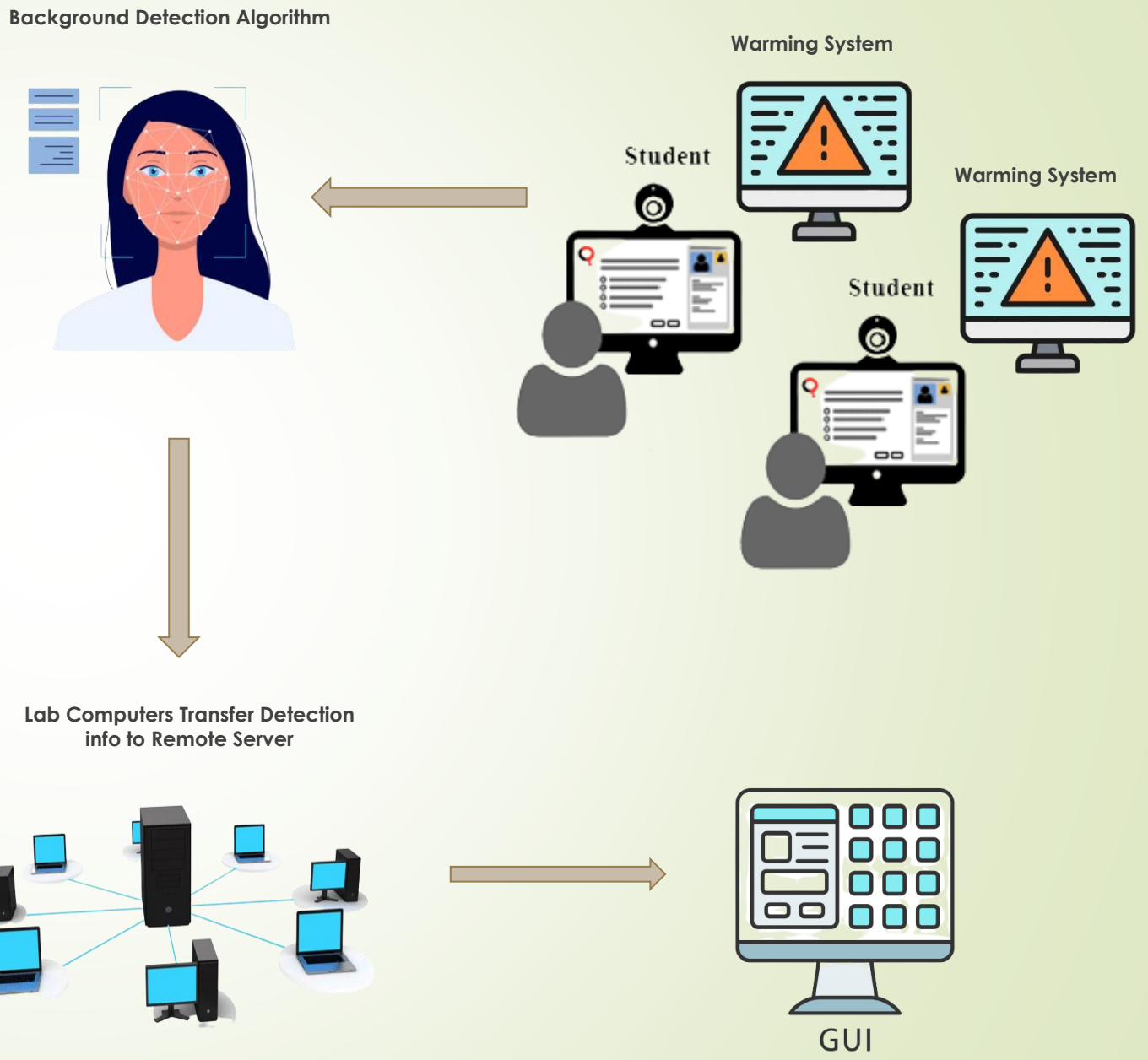
- Lighting
- Pose

03 Real-time and push notifications

04 Multiple detections notified

The Proposed System

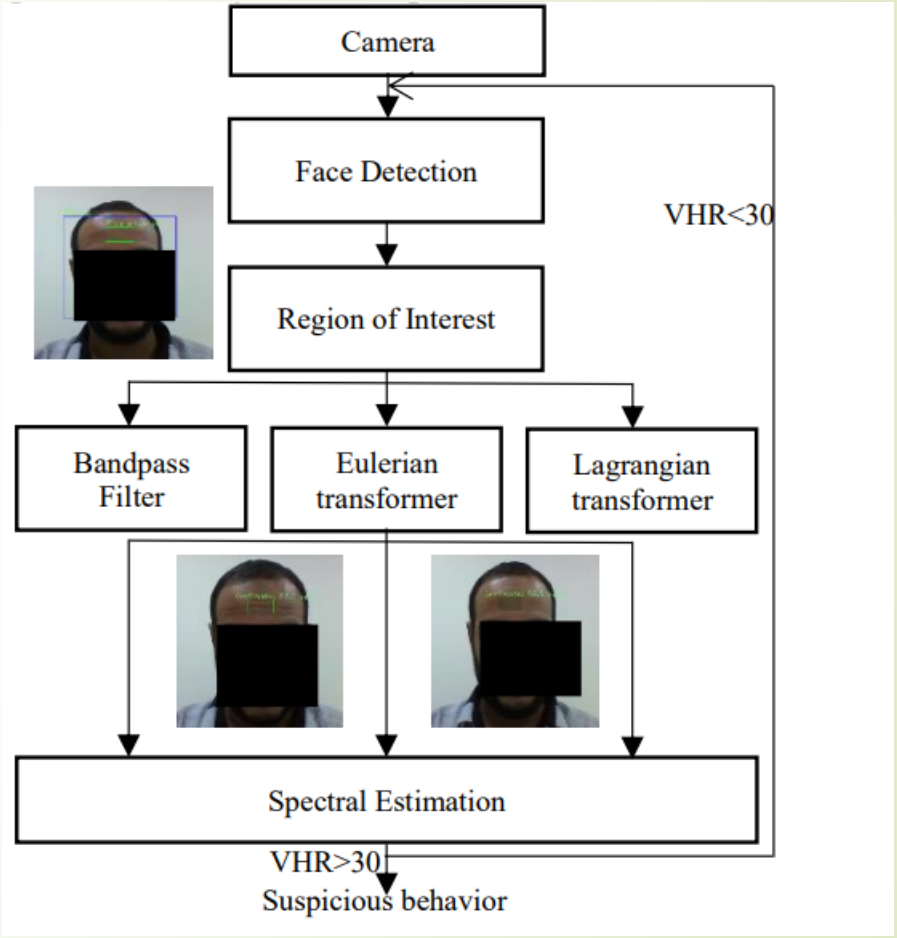
- Student Monitoring
- Warning System
- Suspicious Activity Detection Algorithm
  - Multiple Face Detection
  - Face Orientation Detection
  - No Face Detected
- Remote Server
- Graphical User Interface



Research on

Suspicious Behavior Recognition Based on Facial Features [1]

- Fear - a suspect behavior
- Heart rate estimation system
  - **Bandpass Filter**
  - **Eulerian Transformer**
  - **Lagrangian Transformer**
- **CK+** Dataset

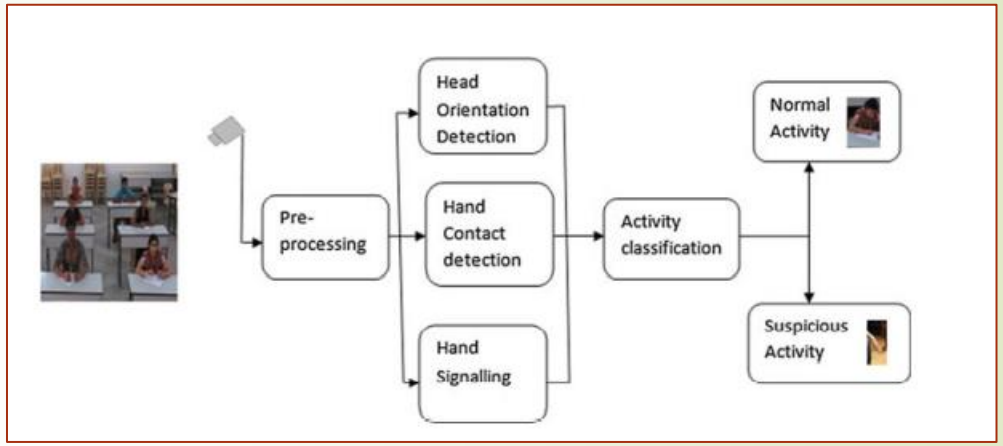


[1] Mossaad, Ben Ayed & Elkosantini, Sabeur & Alshaya, Shaya & Abid, Mohamed. (2019). Suspicious Behavior Recognition Based on Face Features. IEEE Access. PP. 1-1. 10.1109/ACCESS.2019.2947338.

Research on

Suspicious Human Activity Detection in Classroom Examination [2]

- Head Orientation Detection
  - Using **HAAR** features
  - Using **AdaBoost** classifier
  - Head pose variation beyond the **threshold value**
- Hand Signaling Detection
  - Using **Convex Hull of Hand Contour**
- Hand Movement Detection
  - **Dilation** and **Erosion**



[2] Senthilkumar, T., Narmatha, G. (2016). Suspicious Human Activity Detection in Classroom Examination. In: Senthilkumar, M., Ramasamy, V., Sheen, S., Veeramani, C., Bonato, A., Batten, L. (eds) Computational Intelligence, Cyber Security and Computational Models. Advances in Intelligent Systems and Computing, vol 412. Springer, Singapore. https://doi.org/10.1007/978-981-10-0251-9_11

Research on

Automated Invigilation System for Detection of Suspicious Activities during Examinations [3]

- Histogram of Oriented Gradients *(**HOG**) Detection algorithm*
- **Haar** Feature Classifier
  - A part of **Viola Jones algorithm**
    - Fast in locating the mouth regions and face
    - **Open Mouth Detection –** With **threshold limit**
- **AdaBoost**
  - Performance boosting algorithm
  - Sensitive to noise and outliers

[3] M. Adil, R. Simon and S. K. Khatri, "Automated Invigilation System for Detection of Suspicious Activities during Examination," 2019 Amity International Conference on Artificial Intelligence (AICAI), 2019, pp. 361-366, doi: 10.1109/AICAI.2019.8701263.

Research continued .....

Automated Invigilation System for Detection of Suspicious Activities during Examinations [3]

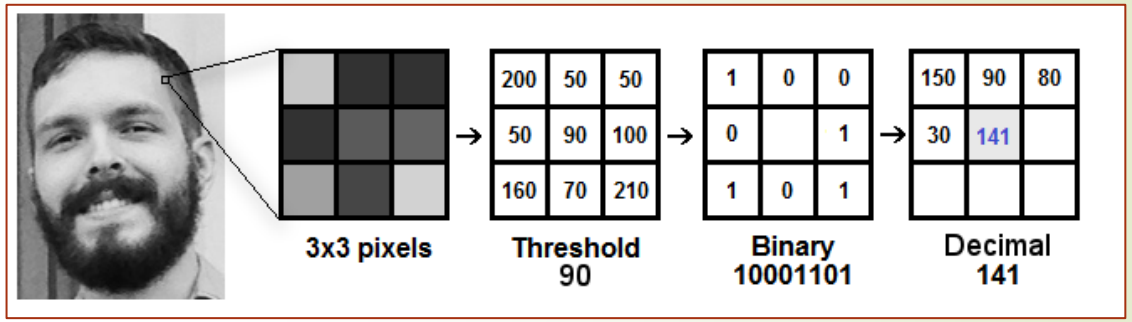
- **Principal Component Analysis (PCA)**
  - **Eigen Face** approach – simple & robust
- **Hand Contact** Detection
  - Overlapping grid is detected outside own body grid
- **Head Orientation** Detection
  - Using the Principal Component Analysis along with the Viola Jones algorithm
  - Based on the threshold

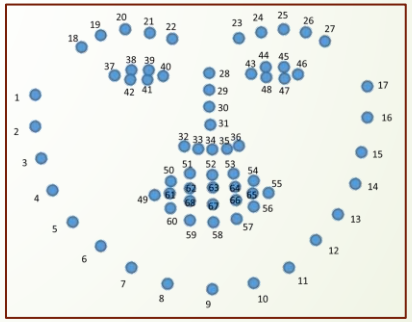
[3] M. Adil, R. Simon and S. K. Khatri, "Automated Invigilation System for Detection of Suspicious Activities during Examination," 2019 Amity International Conference on Artificial Intelligence (AICAI), 2019, pp. 361-366, doi: 10.1109/AICAI.2019.8701263.

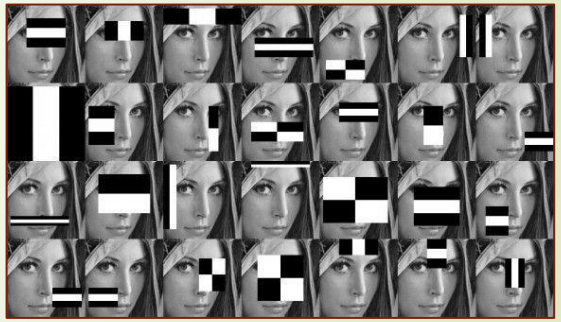
Research on

Inference-Based Statistical Analysis for Suspicious Activity Detection Using Facial Analysis [4]

- **Face Detection**
  - **Local Binary Pattern (LBP)** Operator
    - Overcomes problems in PCA
  - **Haar** cascade algorithms
    - To prevent false results
  - **Dlib**
    - A **face landmark detector** with pre-trained models







[4] M. Rastogi, R., Jain, R., Jain, P., Singhal, P., Garg, P., Rastogi, M. (2020). Inference-Based Statistical Analysis for Suspicious Activity Detection Using Facial Analysis. In: Das, A., Nayak, J., Naik, B., Dutta, S., Pelusi, D. (eds) Computational Intelligence in Pattern Recognition. Advances in Intelligent Systems and Computing, vol 1120. Springer, Singapore. https://doi.org/10.1007/978-981-15-2449-3_3

Research continued …

Inference-Based Statistical Analysis for Suspicious Activity Detection Using Facial Analysis [4]

- **Face Expression** classification
  - Linear support vector machine **SVM model**
  - **CK+** dataset
- **Face Alignment**
  - **SIFTROI** - a preprocessing method
- **Face feature** extraction
  - LBP, Supervised descent technique, WLD, WPLBP, HOG, ICA, PCA

[4] M. Rastogi, R., Jain, R., Jain, P., Singhal, P., Garg, P., Rastogi, M. (2020). Inference-Based Statistical Analysis for Suspicious Activity Detection Using Facial Analysis. In: Das, A., Nayak, J., Naik, B., Dutta, S., Pelusi, D. (eds) Computational Intelligence in Pattern Recognition. Advances in Intelligent Systems and Computing, vol 1120. Springer, Singapore. https://doi.org/10.1007/978-981-15-2449-3_3

Demonstration of this project…

Suspicious Activity Detection Algorithm as a background application.

The **Remote Server** to which the information (time, pc info) related to the detected Suspicious Activity is sent in real-time.

The **GUI of the App** to show the detected suspects to the lab assistant or any other official.

Thank You!