

Suspicious Face Recognition

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

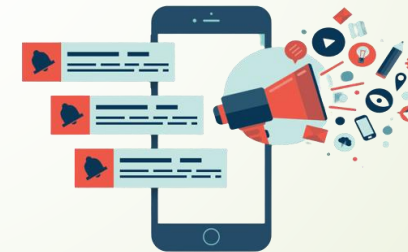
- Lighting
- Pose

03

Real-time and push notifications

04

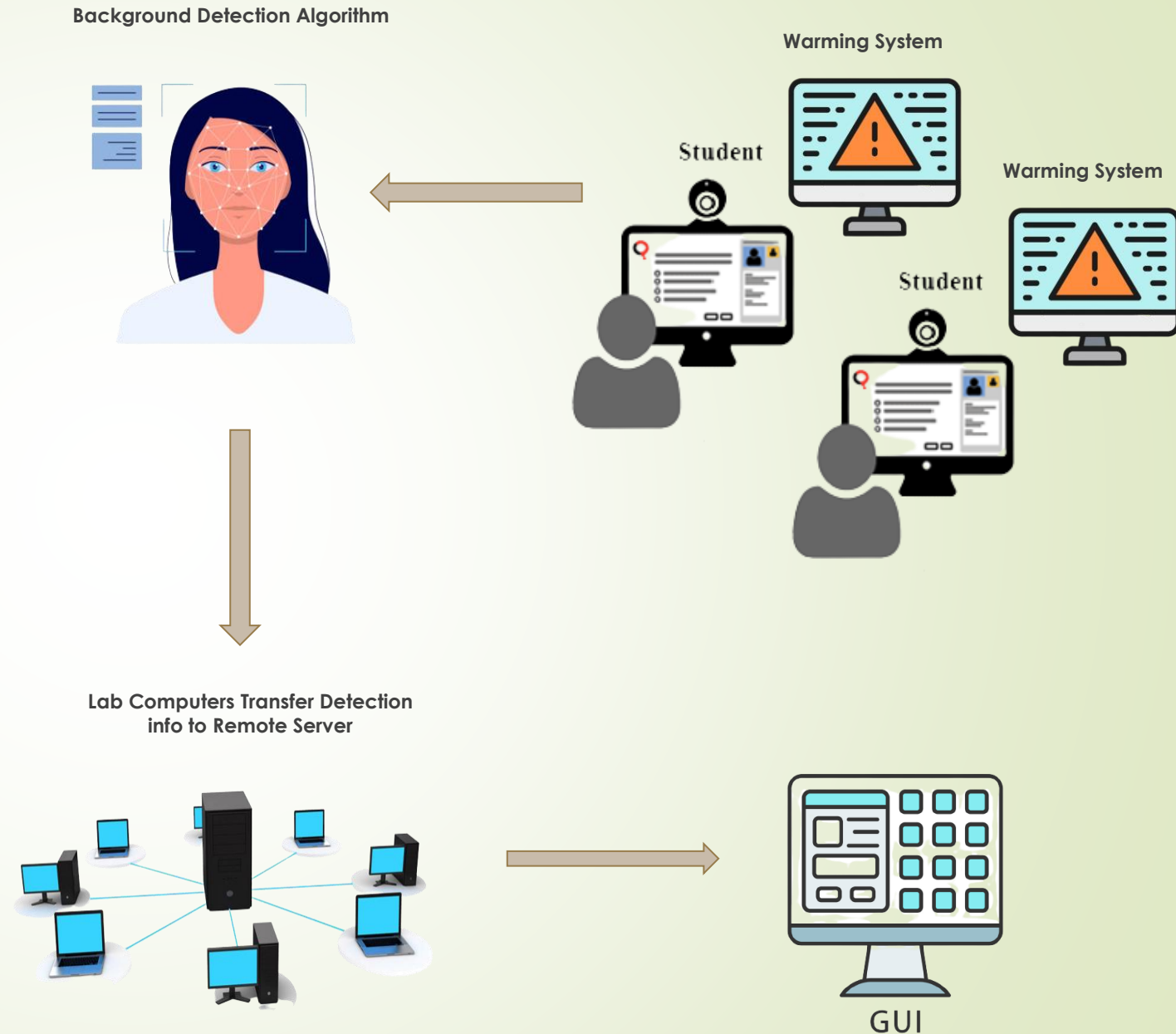
Multiple detections notified



SCREEN									
A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
D1	D2	D3	D4	D5	D6	D7	D8	D9	D10
E1	E2	E3	E4	E5	E6	E7	E8	E9	E10
F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
G1	G2	G3	G4	G5	G6	G7	G8	G9	G10

The Proposed System

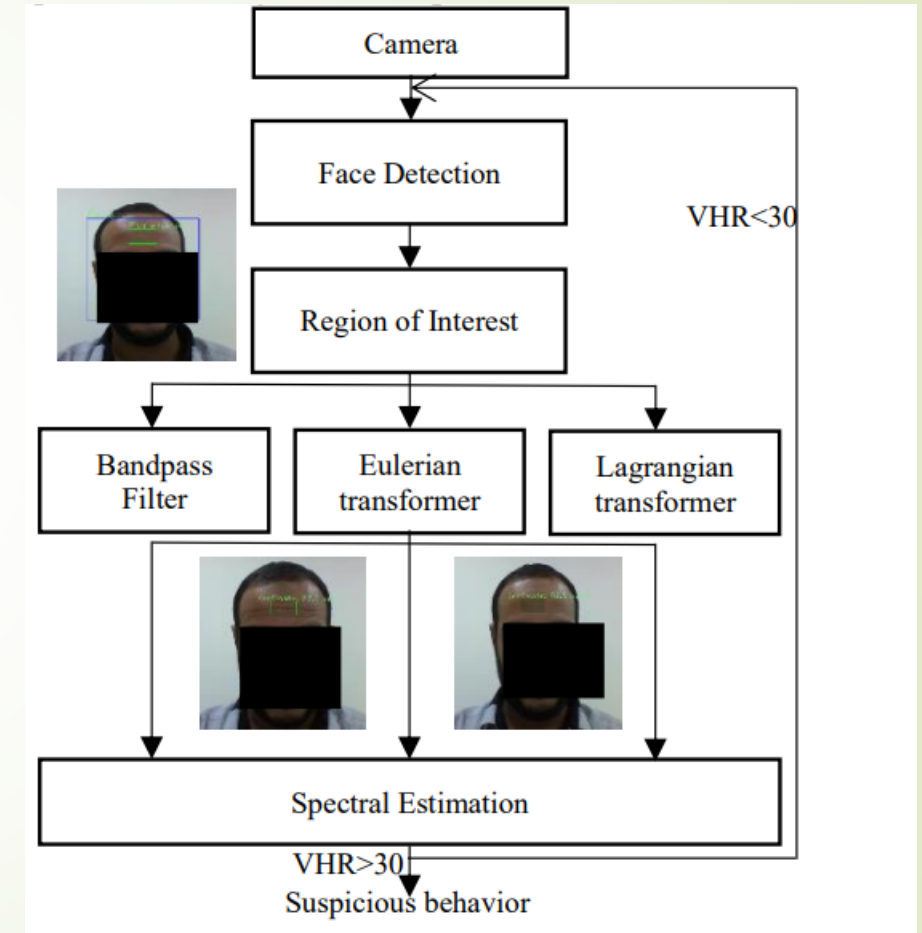
- ❑ Student Monitoring
- ❑ Warning System
- ❑ Suspicious Activity Detection Algorithm
 - Multiple Face Detection
 - Face Orientation Detection
 - No Face Detected
- ❑ Remote Server
- ❑ Graphical User Interface



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

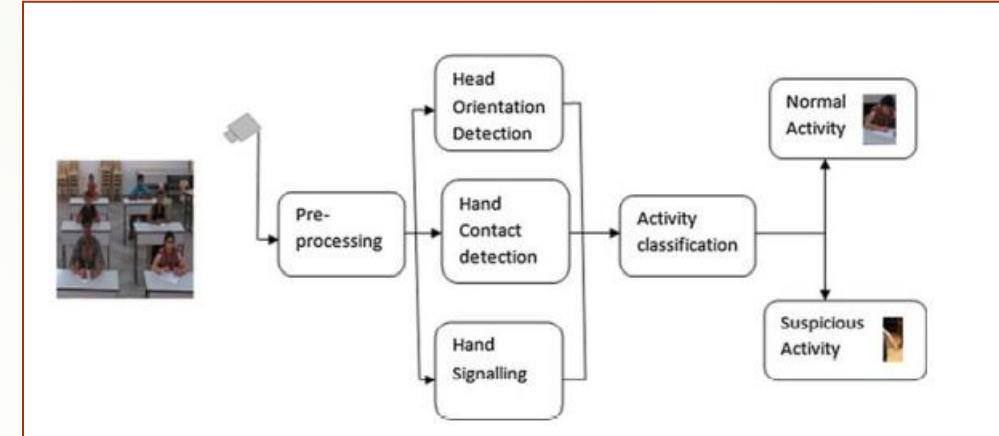
- Using **HAAR** features
- Using **AdaBoost** classifier
- Head pose variation beyond the **threshold value**

➤ 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



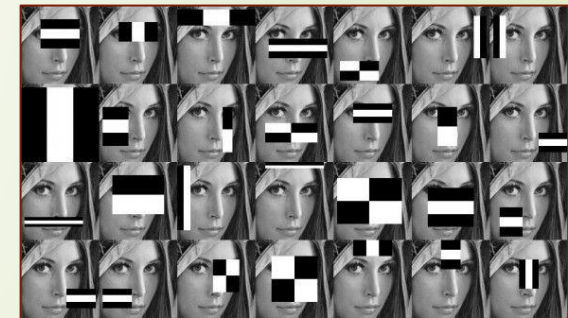
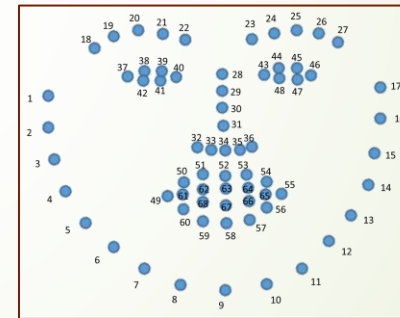
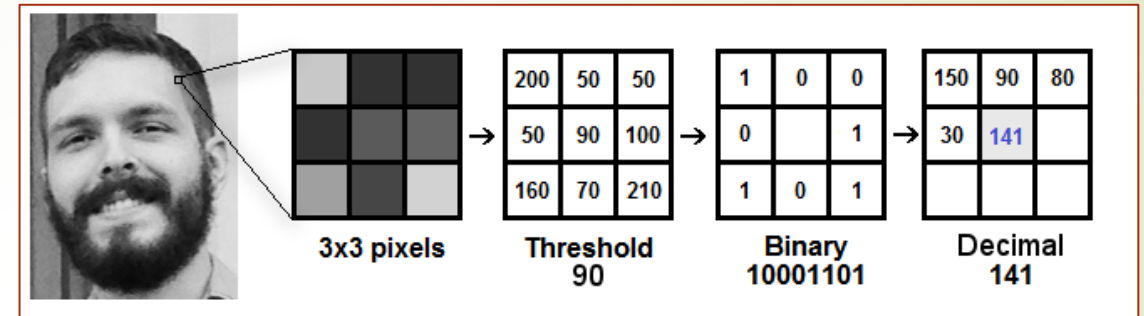
³ M. Adil, R. Simon and S. K. Khatri, "Automated Invigilation System for Detection of Suspicious Activities during Examination," 2019 Amity International Conference on Artificial Intelligence (AICAI), 2019, pp. 361-366, doi: 10.1109/AICAI.2019.8701263.

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.

An illustration of a GUI screen titled 'SCREEN'. It displays a grid of 70 buttons arranged in 7 rows and 10 columns. The buttons are labeled A1 through G10. The buttons in the 5th, 6th, and 7th rows are highlighted in red, while the others are blue.

SCREEN									
A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
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E1	E2	E3	E4	E5	E6	E7	E8	E9	E10
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G1	G2	G3	G4	G5	G6	G7	G8	G9	G10

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

Thank You!