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Stress Detection in IT Professionals by Image Processing and Machine Learning

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***Abstract*— In today's highly competitive and demanding IT industry, mental health concerns, particularly stress-related issues among professionals, have become increasingly prevalent. This paper addresses the crucial issue of stress detection in IT professionals by employing advanced techniques in machine learning (ML) and image processing (IP). The proposed system aims to detect and assess stress levels by analyzing facial expressions captured via image processing, coupled with survey-based assessments. This research investigates the application of ML algorithms for stress detection and proposes a comprehensive system capable of identifying stress triggers and levels among IT professionals.**

***Index Terms*— Stress Detection, Machine Learning, Image Processing, IT Professionals, Facial Expression Analysis**

I. INTRODUCTION

The IT industry is known for its fast-paced and demanding work environments, often leading to increased stress levels among professionals. Stress-related problems not only affect the individual's well-being but also impact work productivity and overall organizational success. Hence, there is a pressing need to develop effective tools and methodologies to detect and manage stress in IT professionals.

Recognizing and addressing stress among IT professionals is crucial for maintaining a healthy workforce and ensuring sustained productivity. Traditional methods of stress detection often rely on self-reported surveys or physiological measurements. However, these methods may not effectively capture real-time stress indicators or underlying psychological stress factors.

In response to this challenge, our project aims to develop an innovative stress detection system that harnesses the power of advanced technologies—machine learning (ML) and image processing (IP). By leveraging facial expression analysis through image processing techniques, our system can detect stress indicators in real-time based on subtle emotional cues exhibited by IT professionals. The utilization of ML algorithms enables the system to classify these expressions, providing insights into the stress levels experienced by individuals.

This project intends to bridge the gap between conventional stress detection methods and modern technological advancements. By integrating ML-based facial expression analysis with comprehensive survey-based assessments, the system can offer a more holistic approach to stress detection in IT professionals. The development of such a system not only facilitates early identification of stress but also lays the foundation for tailored interventions, enabling organizations to proactively address stress-related issues and create a more supportive work environment.

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II. Architecture

A. Image Detection Module

Input: Images (Either upload image or live cam) captured by a device.
Processing: Utilizes image processing techniques for image analysis.Extracts key features from the images for stress detection. Then Machine learning techniques like knn(K-nearest neighbor) and cnn(Convolutional neural networks) are used to detect stress.
Output: Real-time feedback on the face in the image or live camera.

B. Survey-based Assessment Module:

Input: User-generated data through Predefined questionnaire.
Processing: It is done by giving scores to each option and calculating the total score and comparing it with the threshold score.
Output: Real-time feedback after submission.

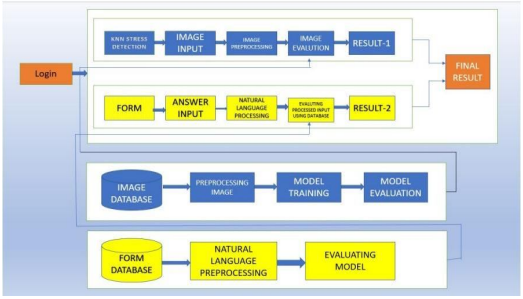

Figure 1. Displays the arhcitecture of the stress detecting system.

III. Methodology

A. Module 1: User Authentication and Access Control

Technology Used: Django (Python web framework)
Code Explanation:
Used Django's built-in authentication system (django.contrib.auth) for user authentication.
Implemented access control using Django's @login_required decorator to restrict access to certain views or functionalities.

B. Module 2: Web Pages(HTML Templates)

Technology Used: HTML,CSS,Bootstrap
Code Explanation:
HTML templates created for different pages using Bootstrap for styling.
Templates extended from a base template(base.html) to maintain a consistent layout across the application.
Each page (UserHome.html,UserImageUploadForm.html) represents different functionalities and contents.

C. Module 3: Backend Processing and Machine Learning

Technology Used: Python, Django, Machine Learning libraries (e.g., Keras, scikit-learn)
Code Explanation:
Backend logic written in Python using Django views to handle HTTP requests and responses.
Machine Learning models (e.g.,knn, Keras) integrated for stress detection using image processing or other algorithms.
Views (UserImageUploadForm.html, UserKnnResults.html, User Live Home.html) process image uploads, display results, and interact with the ML models.

D. Module 4: Survey Form Integration

Technology Used: Django Forms, HTML, Python
Code Explanation:
A Django model to represent survey questions and options is created.

Implemented views (survey_form, process_survey) to render the survey form, handle form submissions, and calculate scores based on user responses.
Templates to display the survey form and show the result based on the calculated total score

E. Module 5: Database Management

Technology Used: Django ORM, SQLite or other DBMS
Code Explanation:
Used Django's ORM to interact with the database.
Models created to represent different data entities (e.g., User model, Survey model).
Migration files generated and applied to maintain the database schema.

F. Module 6: Frontend-Backend Interaction and Routing

Technology Used: Django URL dispatcher
Code Explanation:
Defined URL patterns in Django's urls.py to route HTTP requests to appropriate views.
URL patterns set up for different functionalities/pages (e.g., UserHome, UploadImageForm, UserKnnResults) to handle user interaction.
Technology Used: Django (Python web framework)

IV. Results And Discussion

Figure 2. Home page of the system .

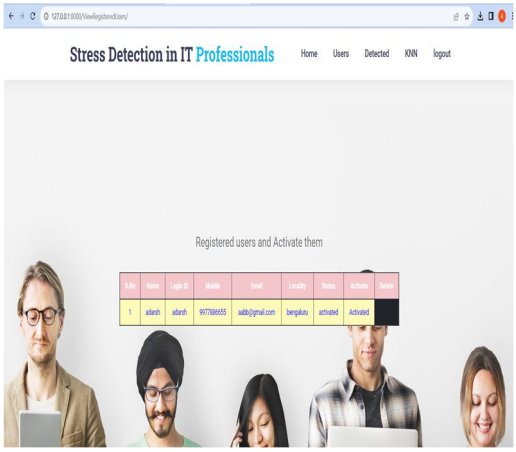

Figure 3. Displays what all Admin can do.

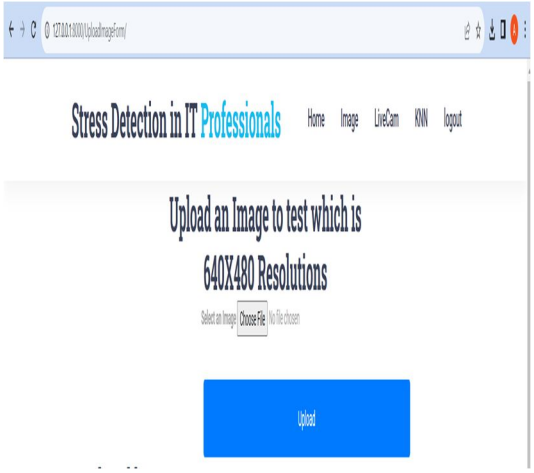

Figure 4. Describes the image upload option.

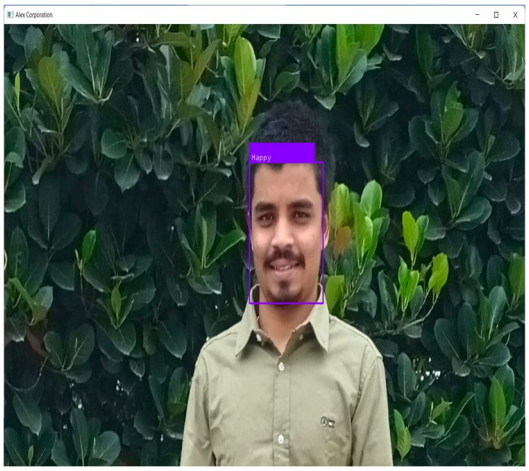

Figure 5. Results obtained from KNN-results.

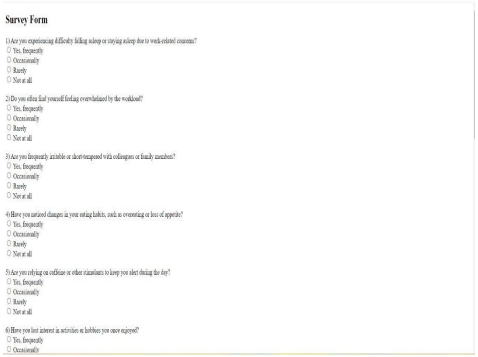

Figure 6. Displays the sample questions asked for the survey based detecting system.

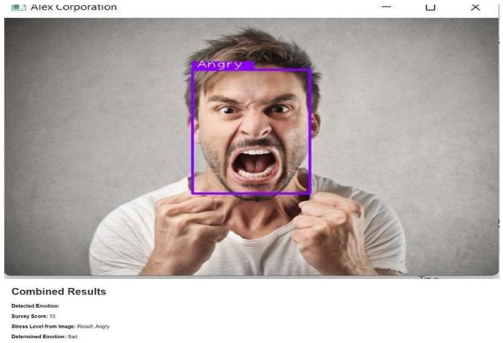

Figure 7. Final results based on both analyses.

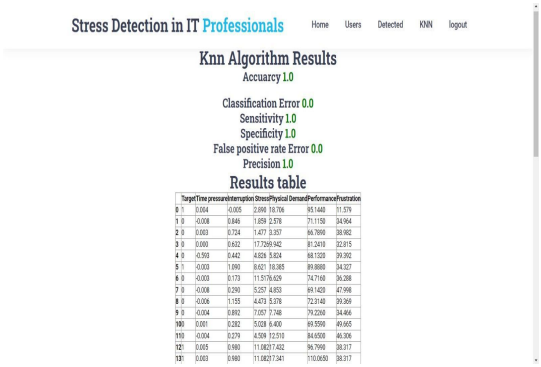

Figure 8. Displays the accuracy , precision and other measurements.

V. Acknowledgment

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References

[1] Mohammadi, M. Fakharzadeh and B. Baraeinejad, "An Integrated Human Stress Detection Sensor Using Supervised Algorithms," in IEEE Sensors Journal, vol. 22, no. 8, pp. 8216-8223, 15 April 15, 2022, doi: 10.1109/JSEN.2022.3157795.

[2] Shruti, M. Harshini, J. Philip and I. V. S. L. Haritha, "Stress Level Detection of IT Professionals Using Machine Learning," 2022 13th International Conference on Computing Communication and Networking Technologies (ICCCNT), Kharagpur, India, 2022, pp. 1-5, doi: 10.1109/ICCCNT54827.2022.9984367.

[3] L. M. Kunjachen and R. Kavitha, "Comparative Study on Detection of Heart Disease using KNN Algorithm," 2022 6th International Conference on Electronics, Communication and Aerospace Technology, Coimbatore, India,2022,pp.14-19,doi:10.1109/ICECA55336.2022.10009559.

[4] S. R. Anthay, V. Nagarjuna, T. V. Mahesh, T. Aravind Royal and S. V. Varma, "Detection of Stress in Humans Wearing Face Masks using Machine Learning and Image Processing," 2022 3rd International Conference on Electronics and Sustainable Communication Systems (ICESC), Coimbatore, India, 2022, pp. 1104-1110, doi: 10.1109/ICESC54411.2022.9885552.

[5] S. K. Kanaparthi, S. P, L. P. Bellamkonda, B. Kadiam and B. Mungara, "Detection of Stress in IT Employees using Machine Learning Technique," 2022 International Conference on Applied Artificial Intelligence and Computing (ICAAC), Salem, India, 2022, pp. 486-493, doi: 10.1109/ICAAIC53929.2022.9793195..