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Ecstatic Deception from Video using Oxidase Zest

V. Aravindh[1], L. Malliga Arjunan[2], P. Naveen[3], Mr. A. Mahan Gopi[4], Dr. Rajini Girinath.[5]
[1,2,3]UG Students, [4]Associate Professor, [5]Professor, Dept of Computer Science And Engineering
Sri Muthukumaran Institute Of Technology, Chennai, India.

Abstract: ***To represent complex human emotional expressions Various Dimensional models has been used. Activation and valence are two common dimensions in such models. They can be used to describe certain emotions. This project proposes to recognise emotion of humans. Using multitask learning frame work which uses Thermal images. Thermal imaging is an efficient technology to detect the deception of the person (subject) during the enquiry or interview and it saves time. Dimensional models have been proposed in psychology studies to represent complex human emotional expressions. Two common dimensions in such models are Activation and valence. They can be used to describe certain emotions. This project proposes to recognize emotion of humans. Using multitask learning frame work which uses Thermal images. We report an 87% ability to predict the lie/truth responses based on a within-person methodology and fivefold cross validation. Our results also show that the between person approach for modelling deception does not generalize very well across the training data.***
Keywords: thermal imaging, dimensional models, deception

I. INTRODUCTION

Various studies shows that both idle people and trained experts are poor at contrasting between liars and truth tellers [1], [2] and for an average person performance is only slightly better than chance. Empirical evidence indicates that differences between cognitive processes will often make liars experience a different mental state than truth tellers. Liars may experience list of feelings such as guilt, anxiety, anger, disgust, fear, and shame more often than others. Polygraph technology involves various contact sensors to measure changes in blood pressure, respiratory, cardiovascular, and electro dermal activity. However, manual analysis takes time and makes the outcome expert dependent. Processing of a typical 10-minute interrogation session using polygraph technology may take several hours. Deception can be obtained through Behavioural and facial-based approaches which are unobtrusive and do not require the subject's cooperation. To distinguish truth tellers from deceivers, behavioural changes and measurable physiological can be used from the assumption of guilt manipulation. Thermal imaging offers a non-contact approach of measuring physiological features like blood flow, pulse rate, blood vessels distribution, and breathing rate Skin surface temperature is captured by Thermal cameras which will vary due to specific-emotion bio-physiological states in human body. Thermal imaging technology – used to detect stress levels in humans based on the radiated heat from their periorbital region. Thermal imaging techniques have been studied to detect deception in mock-crime scenarios. Both instantaneous and sustained stress conditions can be detected using thermal imaging since instantaneous stress brings about an increase in the periorbital blood flow while sustained stress is associated with elevated blood flow in the forehead. Classifying responses as deceptive or truthful can be achieved by finding relevant patterns in the input features using statistical or machine learning techniques.

II. METHODOLOGY

For capturing the image of the participants, we used a cooled mid-infrared camera: FLIR E5 series. The specified resolution of the camera is 10,800 pixels (120 x 90). Thermal imaging cameras don't actually see the temperature of the object. Instead, they capture the infrared (IR) energy that is transferred from an object to its environment and produce a real-time image in a colour palette where hotter objects appear brighter (bright yellow) and cooler objects appear darker (violet) in figure 1. The choice of periorbital region is due to numerous blood vessels surround the eye and it is easy to locate using ROI , but of particular interest are the angular artery and angular vein, both of which run directly beneath the periorbital region of their associated eye .This surrounds the eye and acts to close the eyelid while they are trying to speak lie during the profile test or the interview.

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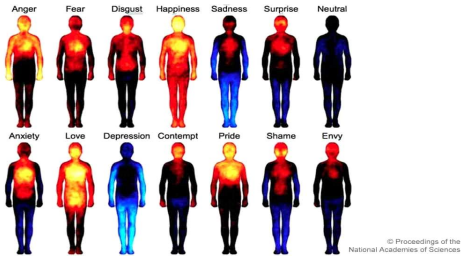
Figure.1. Thermal image indicating hot and cold region.

Test is conducted by two sessions and recorded using the FLIR E5 series camera. In the first session, the questions are asked from candidate's own profile and the thermal images obtained are taken as the true image. In the second session, the candidates are asked to study the fake profile, then questions were asked from that profile and the thermal images obtained are taken as the lie image[4]. Then by using the FLIR Tools software, the thermal data's are extracted from the thermal images. The thermal data's extracted from the first session are taken for the truth values and the thermal data's extracted from the second session are taken for the lie values. Read the thermal image and its corresponding thermal data excel file that is for the whole thermal image in the MATLAB. Then by plotting the ROI in the left and right eye corner region of the thermal image, the thermal data's on those regions are obtained. Train the classifier by the thermal data's that is obtained from those regions using the within person approach. Classify the thermal data's of thermal images using the trained thermal data's as deception detected or no deception detected by the KNN classifier.

III. TECHNIQUES USED TO DETECT EMOTION DECEPTION

There is a thermal signature for Emotions or may be categorized by activity of the autonomic nervous system, which in turn provides a thermal imprint through which it can be detected. In fact, thermal imaging has been specified as a possible tool to build up an atlas of the thermal expression of emotional states, given the use of proper classification algorithms. There is a thermal signature for Startling, distress, fear, sexual arousal, and even deception that can be detected with thermal images cameras. One study for example suggested that temperature and cutaneous blood stream observing of the periorbital pitcher during interrogation provides 87.2% accuracy in detecting deceptive individuals.



IV. CHARACTERISTICS OF THERMAL IMAGING

Thermography (thermo vision) is the imaging process in the mid-infrared Band - the wavelength from 0.9 to 14μm. It allows the registration of the thermal radiation emitted by a physical body in the range encountered in every day conditions, without the external light source. The result of such measurement is the visible image of the temperature distribution on the surface of the measurement object called thermo gram. For such measurement, special thermal imaging cameras are used Depending on the temperature each body emits a certain amount of infrared radiation. Variation in the temperature of the body is replicated in change in the deliberation of radiation. For the measurement of "thermal radiation" used in the radiation. Thermometry, a band of wavelengths between 1μm and 20μm is used. The intensity of the emitted radiation depends also on the type of material. This constant, depending on the material, is described as emissivity, which is a recognized value for most materials. Thermo graphic cameras have optoelectronic sensors. They calculate the surface temperature by measuring the infrared energy radiated by the object's surface. The most significant Feature of infrared thermometers and thermal imaging cameras is that the measurement is

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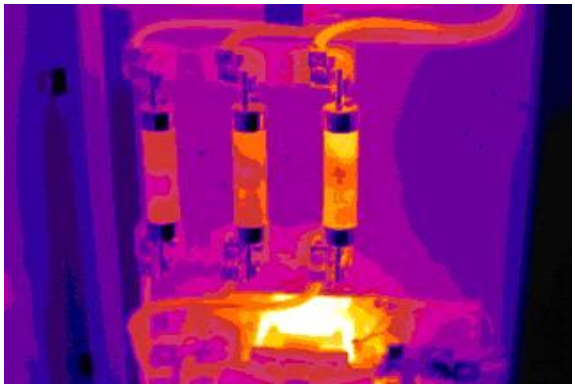
made without contact with the object's surface. As a result, these devices allow for noninvasive temperature measurement for facilities that are not accessible or are in motion. Well accepted Fact in literature that human emotion is a Manifestation of existing psychological state and it gets mirrored in physiological circumstances like blood flow rate, heart Rate, pupil contraction etc. The way of reflection in body temperature, blood flow rate, muscle events is very much emotion specific which specifies that skin temperature may be a clear indication of the current emotional state.

V. THERMAL IMAGING CAMERA APPLICATIONS AND USES

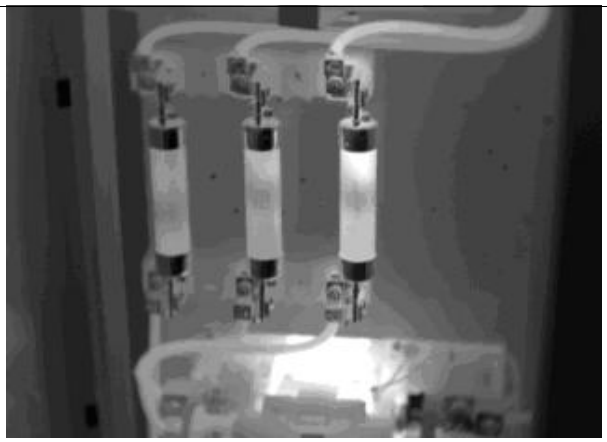
Formerly established for military use during the Korean War, thermal imaging cameras have migrated into other fields and have found many uses. Firefighters use them to see through smoke, catch people and pinpoint hotspots of fires. Law enforcement uses the equipment to manage tailing activities, locate and apprehend suspects, investigate crime scenes and conduct search and rescue operations. Power line preservation specialists locate overheating joints and parts to eliminate potential failures. Where thermal insulation becomes faulty, building construction specialists can see heat trickles to progress the efficiencies of cooling or heating. Physiological activities, such as fever, in human beings and other warm-blooded animals can also be monitored with thermo graphic imaging. They are also common tools used by home inspectors.

A. Thermal Imaging Camera Features

Thermal imaging cameras can be purchased with the bare minimum of features that only recite the temperature of the static center crosshairs on the display or with numerous features that allow the user to select multiple moveable crosshairs and draw comparisons between them to show the high, low and average temperatures on the display. Thermal imaging cameras have user-selectable multiple color palettes, such as black/white, iron or rainbow. The iron palette is furthermost frequently used by home assessors. The black/white palette comforts identify details on an image, and the rainbow palette has the best thermal sensitivity for displaying the differences in temperature. See sample images below of some color palettes.



Iron palette of fuse bus bar



Black/white/gray palette

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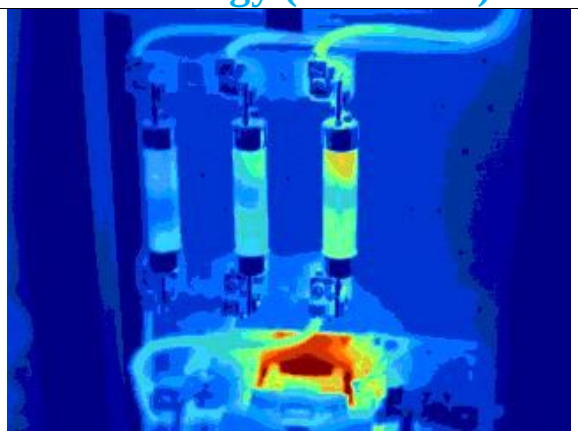
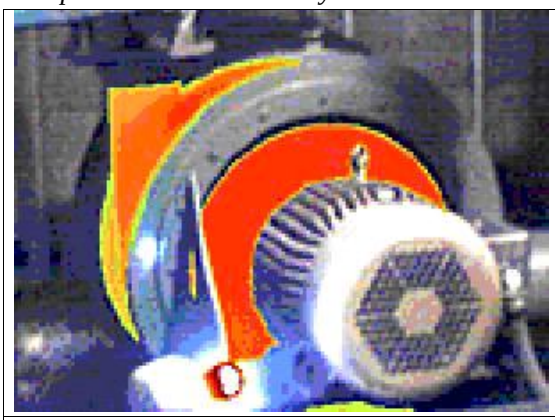
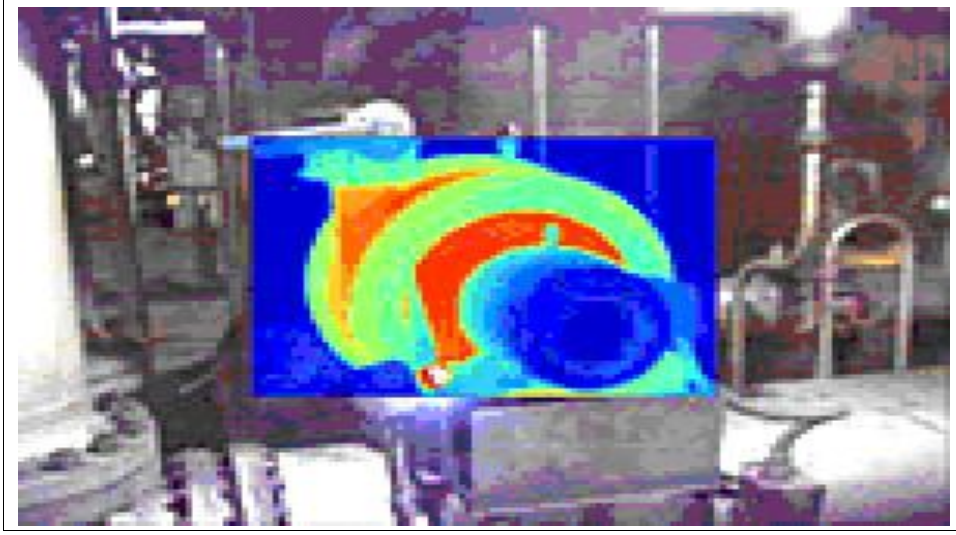


Rainbow palette

B. More Sophisticated Cameras may Include



A colour alarm feature that allows the user to select a temperature. The camera will only display a colour thermal image of anything that is whichever above or below the particular temperature.



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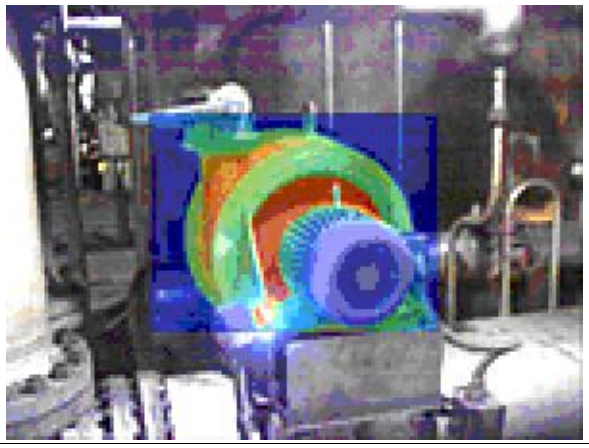
A picture-in-picture feature that will display a colour thermal image (which is a quarter of the size of the display) inside a standard digital image. Temperature interpretations are limited to the thermal percentage of this feature. 	

A fusion or blending feature allows the user to blend either the supreme, slightest or average temperature of the thermal image with a standard digital image [7].

VI. CONCLUSION

In this, decomposed expression transition from a query video sequence was matched against some of the abundant partial expression transitions across different training video sequences. This strategy improves the discriminative capability for FER. To consolidate the individual analyses, a novel discriminative aggregation method using sparsity based weighting scheme was incorporated. This increases the possibility of matching a partial expression transition in the query video sequence, against the partial expression transition.

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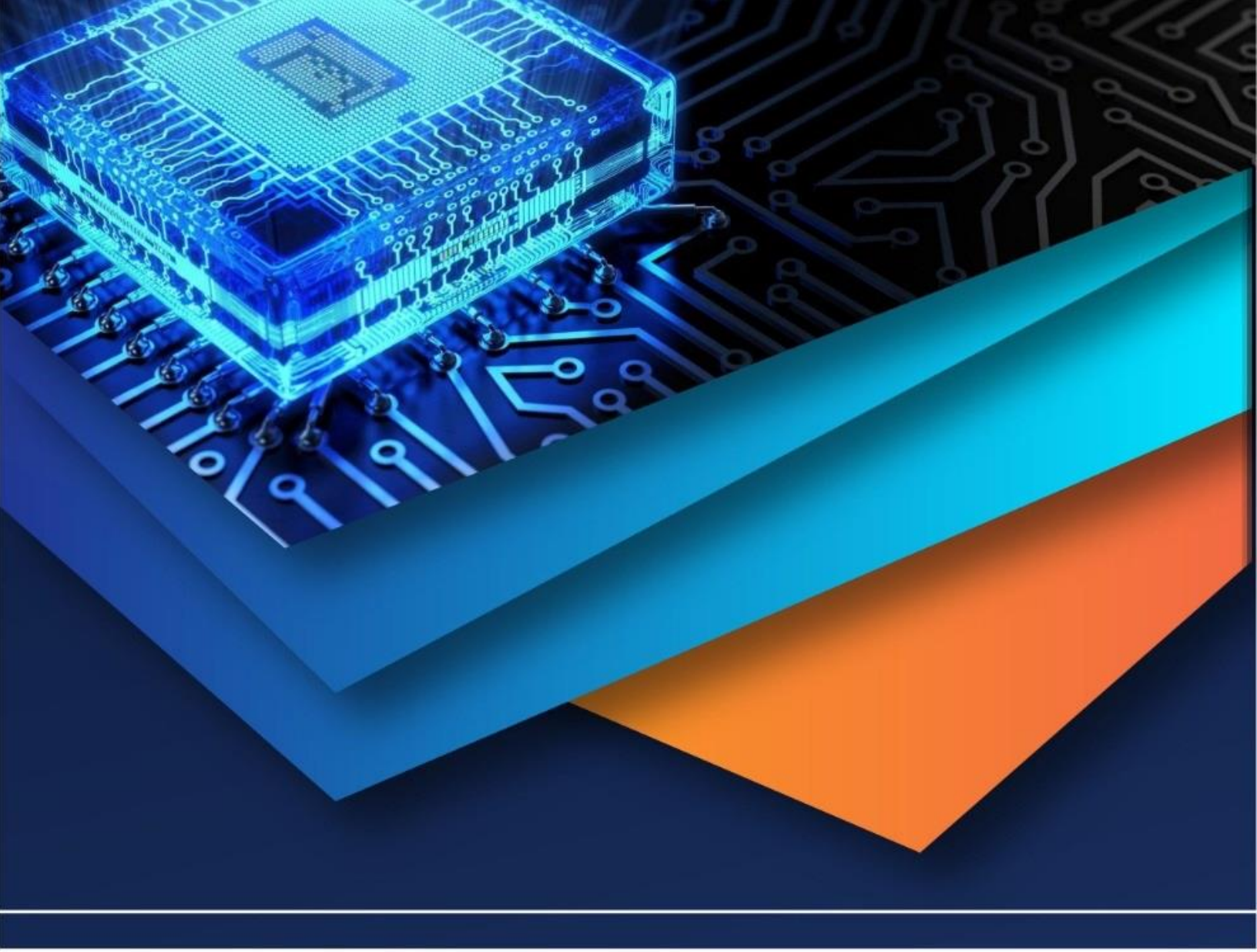

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