Stress Detection Using Classification Algorithms To Measure CPU and GPU Performance

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I. Introduction

In recent years, the trend of applying Machine Learing (ML) concepts to improve decision making, predciting market sentiment, recognizing patterns, affective computing, or interpreting text have gained the attention of many. Within the realm of ML concepts are classification problems where the objective is to classify data entries as either categorical, ordinal, or binary [1, p. 327-328]. As a result, classification algorithms (CAs) were developed using statistical analysis techniques. When applied to a dataset, CAs can provide great insight into common features, known as class, found within the data. Classifiers in particular use the training data to assess how the data's respective attributes fit within the definitions of a particular class with respect to the ground truth [2].

A field of study known as Affective Computing attempts to infer the emotional state of a human being during computer usage. Knowing the emotional state of the user can help machines alter thier content based on this information. Companies can use this on their employee's computers to help improve productivity and health.

This year, a group of researchers introduced a WEarable Stress and Affect Detection (WESAD) dataset that provides a multimodal high-quality dataset with various affective states [3]. The experiment tested for three affective states amusement, stress, and neutral. It also could help determine whether a test subject was or was not stressed. In general, stress and emotion are not mutually exclusive since both rely on the body's central nervous system. This has been a problem within the Affective Computing research field. However, this dataset was made with the intention of bridging this problem. For the purpose of this paper, the focus is geared towards detecting if a user is stressed or not.

II. Related Work

The field of Affective Computing has picked up steam in the last couple of decades. This field of study is interdisciplinary which culminates Computer Science, Computer Engineering, Physcology, and Physiology. With the average employee spending 7 hours a day on the computer, 6 at work and 1 at home, it is important to monitor the health conditions of users during thier time behind a screen [4].

Stress for the human body can affect health and wellness in a negative manner. Both men and women struggle with different facets of it. In particular, the measurement of these stress levels has been improved on beyond that of heart rates and blood pressure measurements. The Feminine Gender Role Stress (FGRS) scale, for example, was used to link women's eating disorders and stress. In 1995, a study concluded that women who have eating disorders also question their body image as a result of their gender role which yielded a higher FGRS rating. These women's FGRS levels were greater than the expected everyday stress for the average person [5]. A study using the Standard Stress Scale (SSS) rating has been used to determine the healthy and non-healthy amount of stress experienced in men. It concluded that the best determinant for high stress levels was through self-rated health [6]. It is important to also note that not all stress is bad. In fact, travel, love, graded exposure to fear and awkward situations, change, and being a beginner all yield positive stress for the human body [7].

Along with these stress level ratings comes error, bias, and variance in technology or simply, the subjects themselves. The goal of modern Affective Computer lies within providing quality, accurate conclusions where other methods are not consistent in. Efforts in facial recognition that classify the affect of a human have been developing in recent years. The changes in muscles across the face lead to attributes that Charles Dawrin infered about universally about humans. These attributes have been consolidated to various class' that have been paired to classification algorithms for further analysis which resulted in 96% accuracy for stationary images [8].

With the dependency of computers steadily increasing over time, the need for machines to interpret a user's affective state is important for their overall health. The contrary could result to ruined relationships or even shortness of life. This paper attempts to focus on stress detection during daily computer tasks to mitigate the negative effects of stress over time.

III. Problem Statement

As mentioned in section II, stress is one of the main causes for serious health concerns. Because of this, there are stress monitors that supervise blood volume, pulse, emotions, and body temperature. Stress and anxiety can occur at any given time. In particular, during computer usage, stress levels can fluctuate as a result of the content or tasks the user is seeing or doing. Using the WESAD dataset, two popular classifiers, Support Vector Machines (SVM) and K-Nearest Neighbor (kNN), are used to help analyze the dataset to detect when and why a test subject became stressed during the course of the experiment. A comparison is then done to compare the performance of utilizing both Central Processing Units (CPUs) and Graphical Processing Units (GPUs) to perfrom this task. Finally, a detailed analysis of benchmarks for each test is provided to determine which method and platform performed the best. Below is a table denoting each testing platorm that will be used for this experiment.

TABLE I
TESTING PLATFORMS AND THIER SPECIFICATIONS

Identifier	Platform	Specifications
A	HP Spectre x360	8th Gen i7, Dedicated NNvidia GPU
B	Custom Desktop	One GPU
C	Custom Desktop	Three GPUs
D	Custom Desktop	6 GPUs
E	Sabine Cluster	5704 CPU Cores, 12 GPU Nodes

Note that in table I, platforms B through D will use the same Nvidia 1080 Ti GPUs and Celeron 6th generation CPU.

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