**Title : Emotion Based Music Recommendation System Using Wearable Physiological Sensors** ***by Deger Ayata, Yusuf Yaslan and Mustafa E.Kamasak***

**Abstract—**Most of the existing music recommendation systems use collaborative or content based recommendation engines. However, the music choice of a user is not only dependent to the historical preferences or music contents. But also de pendent to the mood of that user. This paper proposes an emotion based music recommendation framework that learns the emotion of a user from the signals obtained via wearable physiological sensors. In particular, the emotion of a user is classified by a wearable computing device which is integrated with a ***galvanic skin response (GSR)*** and ***photo plethysmography (PPG)*** physiological sensors. This emotion information is feed to any collaborative or content based recommendation engine as a supplementary data. Thus, existing recommendation engine performances can be increased using these data. Therefore, in this paper emotion recognition problem is considered as arousal and valence prediction from multi-channel physiological signals. Experimental results are obtained on 32 subjects’ GSR and PPG signal data with/out feature fusion using decision tree, random forest, support vector machine and k-nearest neighbors algorithms. The results of comprehensive experiments on real data confirm the accuracy of the proposed emotion classification system that can be integrated to any recommendation engine.

**Index Terms—**Emotion Aware Recommendation Engine, Emotion Recognition, Galvanic Skin Response, Machine Learning, Physiological Signals, Photo Plethysmography.

**Conclusion:** In this study, a framework for enhancing music recommendation engines performance via physiological signals has been introduced. Emotion recognition from multi-channel physiological signals was performed, data fusion techniques were applied to combine data from GSR and PPG sensors and FLF has been implemented. Considering emotion state of the listener improves the performance of recommendations. Recognizing arousal and valence values directly from only GSR and PPG signals is a challenging task. We have showed that there is relationship between GSR and PPG signals and emotional arousal and valence dimensions. For GSR only signal, we have obtained 71.53% and 71.04% accuracy rate for arousal and valence prediction respectively. For photoplehysmography only signal, we have obtained 70.93% and 70.76% accuracy rate for arousal and valence prediction respectively. Fusing GSR and PPG signals we have obtained the results, 72.06% and 71.05% accuracy rate for arousal and valence prediction respectively. Although there is only slight improvement using fusion in emotion recognition accuracy, the proposed framework is promising for music recommendation engines in terms of adding multi modal emotion phenomenon into music recommendation logic. Performance can be improved with the advancement of wearable sensor technologies and using different type of sensors. Using more than one sensor may also help for failure management. As future work, we will consider different combination of sensors that handle the failures of wearable sensors and additional sensors usage to increase performance. The results of this study can be used to increase user experience of multimedia tools and music recommendation engines. Since there is high correlation between physiological GSR and PPG data and affective state and cognitive state of a person multimedia recommendation engines can benefit from physiological computing systems.

**What the Researchers Proposed: An Emotion-Sensing Framework**

The main idea of this paper is not to replace existing music recommendation systems, but to **make them better** by adding real-time emotion detection from wearable sensors.

**Goal:** To improve music recommendations by understanding the user's current mood. Traditional systems mostly look at your listening history or the properties of the music itself.

**How to Detect Emotion:** They use physiological signals from wearable devices because these are more reliable than analyzing facial expressions or voice, which people can fake or hide.

**Sensors Used:** The system uses two specific types of sensors found in many smartwatches and fitness bands:

* **Galvanic Skin Response (GSR):** Measures tiny changes in skin sweat, which can indicate excitement or stress.
* **Photoplethysmography (PPG):** Measures changes in blood volume (related to heart rate), which is also affected by emotions.

**Combining Sensor Data:** They found that by **fusing** the data from both the GSR and PPG sensors, they could predict a user's emotion slightly more accurately than by using just one sensor alone.

**How Emotion is Measured:** The system classifies emotions along two dimensions:

* **Valence:** The polarity of the emotion (is it positive/pleasant or negative/unpleasant?).
* **Arousal:** The intensity of the emotion (is it calming/passive or exciting/active?).

***They achieved an accuracy rate of over 72% for predicting arousal***

**Future Scope:** The researchers have identified several ways to build upon their work and improve the system's capabilities.

**Use Better and Different Sensors:** They plan to improve performance by taking advantage of future advancements in wearable sensor technology and by experimenting with different types of sensors.

**Improve Reliability:** By using multiple sensors, they can create a system that still works even if one sensor fails or provides bad data. This is known as "failure management."

**Increase Performance:** They will explore adding even more sensors and trying different combinations to see if they can make the emotion detection even more accurate.