**EMAP Dataset Challenge: Predicting Affective States and Physiological Responses with Feature Selection**

**Description**

Understanding and predicting human emotional states and physiological responses is a complex challenge with significant implications for affective computing, neuroscience, and human-computer interaction. The Emotion Arousal Pattern (EMAP) dataset offers a rich, multimodal resource that includes neuro- and peripheral physiological signals alongside emotional ratings. Unlike existing datasets that primarily focus on participants' retrospective, single data point ratings of their experiences, often with small sample sizes and nonconcurrent experience sampling, the EMAP dataset provides concurrent data across multiple modalities, collected from up to 145 participants. This comprehensive dataset enables a more detailed exploration of dynamic emotional and physiological processes.

The primary challenge is effectively selecting features from this high-dimensional dataset to classify and predict emotional states (e.g., arousal ratings) and physiological changes (e.g., heart rate and skin conductance).

Evolutionary computation, particularly the feature selection approach, is well-suited to address this challenge due to its ability to explore large, complex search spaces and identify optimal solutions for regression and classification tasks. By focusing on the EMAP dataset, the competition seeks to push the boundaries of feature selection techniques, demonstrating their adaptability and robustness, highlighting their impact on real-world problems.

**Dataset Description**

The Emotional Arousal Pattern (EMAP) dataset contains neurophysiological, peripheral physiological, and self-reported emotional data from 145 individuals recorded while watching various short video clips (see Fig. 1).



Figure 1. Setup illustrating the multimodal approach used in the EMAP dataset to capture neurophysiological and peripheral physiological signals during exposure to emotion-provoking stimuli. The video served to elicit emotional responses in participants, while the recorded data streams include brain activity (EEG), skin conductance, respiration, heart rate, and blood volume.

For ease of use, extracted features from the EMAP dataset are available for participants. These include:

* 256 EEG features and.
* 4 peripheral physiological features: galvanic skin response (GSR), respiration, heart rate (HR), and blood volume.

Resulting in a total of 260 features combined with a moment-by-moment arousal rating.

Participants can request access to the train and validation set of the extracted features through the following link: <https://www.wgtn.ac.nz/psyc/research/emap-open-database>.

Participants are required to train their models on the train set and evaluate their performance on the validation set. The test set will not be provided and will be used to rank participants on the scoreboard.

**Competition Tasks:**

1. **Primary Task (Regression):**
* Implement regression algorithms to predict *arousal, heart rate, and skin conductance* separately using different feature selection approaches.
* Assess the performance of the algorithms using root mean squared error (RMSE) as the evaluation metric.
* Visualize the results by plotting graphs that compare the predicted and true time courses for arousal, heart rate, and skin conductance.
* Report the number of features that achieved that best performance.
1. **Bonus Task (Classification):**
	* Implement classification models to categorize *arousal* ratings.
	* The arousal ratings are in decimal. Therefore, participants would need to convert labels into binary classes as follows:
		1. Class 0: Values between 0.00 and 0.5 (low arousal)
		2. Class 1: Values between 0.51 and 1.0 (high arousal)
	* Evaluate classification performance using the F1-score as the primary metric.

**Established Baselines**

Baselines for predicting arousal ratings (both classification and regression), including the corresponding code, can be found in [1], while baselines for predicting heart rate and skin conductance, along with their code, are available in [2].

Reference:

[1] Eisenbarth, H., Oxner, M., Shehu, H. A., Gastrell, T., Walsh, A., Browne, W. N., & Xue, B. (2024). Emotional arousal pattern (EMAP): A new database for modeling momentary subjective and psychophysiological responding to affective stimuli. *Psychophysiology*, *61*(2), e14446.

[2] Shehu, H. A., Oxner, M., Browne, W. N., & Eisenbarth, H. (2023). Prediction of moment‐by‐moment heart rate and skin conductance changes in the context of varying emotional arousal. Psychophysiology, 60(9), e14303.

**Anticipated Number of Participants**

This is a new competition, so the anticipated number of participants has not yet been established. However, we expect at least 10 participants to join the competition, given the interest shown during initial promotions and inquiries.

**Submission Guidelines**

* Participants should submit a ppt slide describing their approach and their achieved accuracy.
* All participants are required to submit their best model(s) along with a prediction file (e.g., prediction.py) that includes all preprocessing techniques used for evaluating performance on the evaluation set. Placing the test set in the test path and running prediction.py should generate the results.
* A CSV file containing all the selected features.
* All participants are required to provide their source code at the end of the competition. These source codes should be open for all researchers. Participants can upload their source codes to GitHub or other platforms.
* All submission should be made to: afcrinlab@vuw.ac.nz

**Award:**

IEEE CEC 2025 conference certificates will be awarded to the winners of this competition (1st, 2nd and 3rd place).

**Important Dates**

**Submission Deadline:** May 25th, 2025.

**Competition Organizers:**

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**Short Bio**: Dr. Harisu Abdullahi Shehu received the BSc. in computer engineering from Gediz University, Turkey, having graduated as the highest-ranked student from his department. The MSc. degree in computer engineering from Pamukkale University, Turkey and the PhD from Victoria University of Wellington, New Zealand. He serves as a reviewer for international journals such as IEEE Transactions on Affective Computing, IEEE Access, and the IEEE Robotics and Automation Society. He is currently a researcher with Victoria University of Wellington, New Zealand. His research interest focuses on emotion detection from the patterns of facial movements and physiological changes.

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**Short Bio**: Hedwig Eisenbarth received a PhD in Psychology from the University of Würzburg, Germany. She is now an Associate Professor in Psychology at Victoria University of Wellington. Her Affective and Criminal Neuroscience lab investigates emotion processing and social interactions in forensic and general populations.

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**Short Bio**: Prof. Bing Xue received the PhD degree in computer science in 2014 at Victoria University of Wellington (VUW), New Zealand. She is currently a Professor in Computer Science, and Program Director of Science in School of Engineering and Computer Science at VUW. She has over 200 papers published in fully refereed international journals and conferences and her research focuses mainly on evolutionary computation, machine learning, classification, symbolic regression, feature selection, evolving deep neural networks, image analysis, transfer learning, multi-objective machine learning.

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**Short Bio**: Prof. Will N. Browne completed his doctorate on industrial learning classifier systems (LCSs), University of Wales, Cardiff, 1999. After eight years lecturing in Cybernetics, University of Reading, UK, he led the LCS theme with the Evolutionary Computation Research Group in Victoria University of Wellington from 2009 - 2021. He now holds a chair Queensland University of Technology. He has been co-track chair for the evolutionary machine learning tracks and provided tutorials on rule-based machine learning at GECCO, and recently coauthored the ﬁrst textbook on LCSs Introduction to Learning Classiﬁer Systems (Springer 2017). His research focuses on applied cognitive systems, including cognitive robotics, learning classiﬁer systems, and modern heuristics.

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