

INTISARI

METODE *MODIFIED WEIGHTED MEAN FILTER* DAN *CONTINUOUS CAPSULE NETWORK* UNTUK PENGENALAN EMOSI BERDASAR SINYAL *ELECTROENCEPHALOGRAM* PADA PESERTA PEMBELAJARAN

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Reaksi emosi memiliki peran yang sangat penting dalam keterlibatan, daya ingat dan penalaran peserta pembelajaran. Dari beberapa pendekatan, pengenalan emosi berdasar sinyal *Electroencephalogram* memiliki beberapa keunggulan dibandingkan dengan pendekatan eksternal maupun internal lainnya. Namun, beberapa permasalahan pada pengenalan emosi berdasar sinyal *Electroencephalogram*, diantaranya: (1) Sinyal *baseline Electroencephalogram* mengandung *artefact*, sehingga tidak dapat merepresentasikan kondisi netral dari partisipan, (2) Proses *convolution* yang terdapat pada metode *Capsule Network* mengakibatkan hilangnya informasi spasial antar *channels* dan frekuensi band dari sinyal eksperimen *Electroencephalogram*.

Untuk mengatasi masalah tersebut, penelitian ini mengembangkan model pengenalan emosi peserta pembelajaran berdasar sinyal *Electroencephalogram* yang terdiri dari metode *Modified Weighted Mean Filter* untuk menghilangkan *artefact* pada sinyal *baseline Electroencephalogram* metode *Differential Entropy* untuk ekstraksi fitur, menggunakan satu metode yang tepat untuk proses *baseline reduction*, metode *3D Cube* untuk representasi fitur, serta metode *Continuous Capsule Network* untuk klasifikasi.

Berdasarkan keseluruhan eksperimen pada dataset DEAP, DREAMER, dan AMIGOS, dua metode yang diusulkan, yaitu metode *Modified Weighted Mean Filter* dan metode *Continuous Capsule Network* terbukti dapat mengatasi permasalahan dalam penelitian ini. Selain itu dari tiga metode *baseline reduction* yang telah dikaji, metode *Relative Difference* lebih tepat digunakan untuk proses *baseline reduction*. Proses *baseline reduction* dapat menggunakan sinyal *baseline* maupun sinyal eksperimen *Electroencephalogram*. Metode yang diusulkan pada penelitian ini dapat menghasilkan model pengenalan emosi berdasarkan sinyal *Electroencephalogram* yang lebih akurat daripada model pengenalan emosi berdasarkan sinyal *Electroencephalogram* pada penelitian sebelumnya. Model yang telah teruji ini, selanjutnya digunakan untuk mengenali emosi berdasarkan sinyal *Electroencephalogram* pada peserta pembelajaran.

Kata kunci: *Electroencephalogram, Emosi, Baseline Reduction, Continuous Capsule Network, Modified Weighted Mean Filter.*

ABSTRACT

MODIFIED WEIGHTED MEAN FILTER AND CONTINUOUS CAPSULE NETWORK METHOD FOR EMOTION RECOGNITION BASED ON ELECTROENCEPHALOGRAM SIGNALS IN LEARNING PARTICIPANTS

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Emotional reactions have a vital role in learning participants' involvement, memory, and reasoning. From several approaches, emotion recognition based on *Electroencephalogram* signals has several advantages compared to other external and internal procedures. However, there are several problems in emotion recognition based on *Electroencephalogram* signals, including: (1) The baseline *Electroencephalogram* signal contains artefacts, so it cannot represent the neutral condition of the participants, (2) The *convolution* process found in the *Capsule Network* method results in loss of spatial information between channels and frequencies bands of experimental *Electroencephalogram* signals.

To overcome this problem, this study developed a model for recognizing the emotions of learning participants based on the *Electroencephalogram* signal, which consists of the *Modified Weighted Mean Filter* method to remove artefacts in the baseline *Electroencephalogram* signal, the *Differential Entropy* method for feature extraction, using one appropriate *baseline reduction* method, the *3D Cube* for feature representation, as well as the *Continuous Capsule Network* method for classification.

Based on all experiments on the DEAP, DREAMER, and AMIGOS datasets, the two proposed methods, namely the *Modified Weighted Mean Filter* method and the *Continuous Capsule Network* method, are proven to be able to overcome the problems in this study. In addition, the *Relative Difference* method is more appropriate for the *baseline reduction* process of the three *baseline reduction* methods studied. The *baseline reduction* process can use the baseline signal or the *Electroencephalogram* experimental signal. The method proposed in this study can produce an emotion recognition model based on *Electroencephalogram* signals that is more accurate than the emotion recognition model based on *Electroencephalogram* signals in previous studies. This tested model is then used to recognize emotions based on *Electroencephalogram* signals in learning participants.

Keyword: *Electroencephalogram, Emotion, Baseline Reduction, Continuous Capsule Network, Modified Weighted Mean Filter*