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**Hand Gesture Recognition Based on Continuous Wave (CW) Radar Using Principal Component Analysis (PCA) and K-Nearest Neighbor (KNN) Methods**

(2022) *International Journal on Informatics Visualization*, 6 (1-2), pp. 188-194.

**DOI:** 10.30630/joiv.6.1-2.926

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**Abstract**
Human-computer interaction (HCI) is a field of study studying how people and computers interact. One of the most critical branches of HCI is hand gesture recognition, with most research concentrating on a single direction. A slight change in the angle of hand gestures might cause the motion to be misclassified, thereby degrading the performance of hand gesture detection. Therefore, to improve the accuracy of hand gesture detection, this paper focuses on analyzing hand gestures based on the reflected signals from two directions, which are front and side views. The radar system employed in this paper is equipped with two sets of 24 GHz continuous wave (CW) monostatic radar sensors with a sampling rate of 44.1 kHz. Four different hand gestures, namely close hand, open hand, OK sign, and pointing down, are collected using SignalViewer software. The data is stored as a waveform audio file format (WAV) where one data consists of 20 segments, and the data is then examined by using MATLAB software to be segmented. To evaluate the effectiveness of the classification system, principal component analysis (PCA) and k-nearest neighbor (KNN) are integrated. The PCA findings are depicted in Pareto and 2-D scatter plot for both radar directions. The Leave-One-Out (LOO) method is then used in this analysis to verify the accuracy of the classification method, which is represented in the confusion matrix. At the end of the analysis, the classification results indicated that both angles achieved near-perfect accuracy for most hand gestures. 

**Author Keywords**
classification; Hand gesture recognition; KNN; machine learning; PCA

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**Publisher:** Politeknik Negeri Padang

**ISSN:** 25499904
**Language of Original Document:** English
**Abbreviated Source Title:** Int. J. Inform. Vis.
2-s2.0-85132401775
**Document Type:** Article
**Publication Stage:** Final
**Source:** Scopus