



INTISARI

MODEL KLASIFIKASI DENGAN KOMPLEKSITAS RENDAH PADA SISTEM DETEKSI JATUH

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Algoritma *Random Forest* (RF) merupakan salah satu metode deteksi jatuh berbasis akselerometer yang cukup akurat. Namun, algoritme RF menghasilkan model deteksi jatuh dengan kompleksitas tinggi (menggunakan banyak pohon keputusan). Penelitian ini mengembangkan tiga metode yaitu *Splitting Criteria Optimization* (SCO), *Measured Tree Pruning* (MTP), *Accuracy-Based Tree Clustering* (ATC). Metode SCO memilih *splitting criteria* paling optimal sehingga dapat memaksimalkan akurasi setiap pohon keputusan. Metode MTP menemukan kedalaman pohon minimal tanpa mengorbankan akurasi. Metode ATC memangkas cacah pohon keputusan dengan memaksimalkan ketidakkorelasi antar pohon. Model keputusan jatuh dibangun menggunakan data publik sebanyak 42.947 data. Pengukuran akurasi dilakukan menggunakan 10-fold cross validation yang membagi data menjadi 38.652 data untuk training dan 4.293 data untuk testing. Data divalidasi dengan mengujikan model di laboratorium. Hasil penelitian menunjukkan bahwa: 1) Metode SCO mampu memaksimalkan akurasi setiap pohon keputusan sehingga meningkatkan akurasi dari 92,39% (pada algoritme *Random Forest* standar) menjadi 98,61%; 2) Metode MTP mampu memberikan nilai kedalaman minimal pada pohon keputusan untuk mencapai nilai maksimum, dan 3) Metode ATC mampu menghasilkan histogram pohon keputusan yang menunjukkan ketidakkorelasi antar pohon. Histogram ini menjadi acuan untuk mengurangi cacah pohon keputusan dalam model deteksi jatuh dari 21 pohon keputusan (algoritme *Random Forest* standar) menjadi 5 pohon keputusan. Penelitian ini menemukan bahwa kinerja model keputusan yang dihasilkan *Random Forest* dapat ditingkatkan dengan cara meningkatkan akurasi pohon keputusan anggota dan membatasi kedalaman sebelum dilakukan pengurangan jumlah pohon.

Kata kunci: Random Forest, splitting criteria optimization, measured tree pruning, accuracy-based tree clustering



ABSTRACT

LOW-COMPLEXITY CLASSIFICATION MODEL FOR FALL DETECTION SYSTEM

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Random Forest (RF) algorithm is one of the most accurate accelerometer based fall detection methods. However, the RF algorithm produces a fall detection model with high complexity (using many decision trees). This study developed three methods, namely: 1) Splitting Criteria Optimization (SCO), 2) Measured Tree Pruning (MTP), and 3) Accuracy-Based Tree Clustering (ATC). The SCO method selects the most optimal splitting criteria to maximize the accuracy of each decision tree. The MTP method finds the optimal tree depth without compromising its accuracy. The ATC method cuts the number of decision trees by maximizing the uncorrelation between each trees. The fall decision model was built using 42,947 public data. Accuracy measurements are carried out using 10-fold cross validation which divides data into 38,652 data for training and 4,293 data for testing. Data validated by testing the model in the laboratory. The results showed that: 1) The SCO method was able to maximize the accuracy of each decision tree thereby increasing the accuracy from 92.39% (in the standard Random Forest algorithm) to 98.61%; 2) The MTP method is able to provide a minimum depth value in the decision tree to reach the maximum value, and 3) the ATC method is able to produce a decision tree histogram that shows the uncorrelation between trees. Utilizing the histogram as a reference, the number of decision trees in the fall detection model could be reduced from 21 decision trees (standard Random Forest algorithm) to 5 decision trees. This study found that the performance of the decision model produced by Random Forest can be improved by increasing the accuracy of decision trees in the ensemble and limiting depth before reducing the number of trees.

Keyword: Random Forest, splitting criteria optimization, measured tree pruning, accuracy-based tree clustering