

OVERFIT PREVENTION OF HUMAN MOTION DATA BY ARTIFICIAL NEURAL NETWORK

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APPROVAL

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DECLARATION

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ABSTRACT

This report is about overfitting prevention of human motion data. Nowadays, crime is everywhere. To prevent the crimes like burglary, property damage and others rising crimes, a lot of people start to use surveillance system to detect criminal behaviour of human. To ensure surveillance system work, the Close Circuit Television (CCTV) will detect and track the human motion by using deferent method of human motion capturing method such as motion segmentation based on edge detection, and motion recognition. During post-processing stage, the system is compare the human motion data with the others database recognize the motion activity. Sometimes, wrong judgment in post-processing such as misclassification of a running human motion data as walking data or human waving hands data judge as human clapping hands data. All this kind of error call overfitting of human motion data. Objective of this project is to develop a classification method by data Artificial Neural Network (ANN) to prevent the overfitting problem. To achieve my objective, first is to obtain human motion data which is transform the video clip data into numerical data, this is because the Waikato Environment for Knowledge Analysis (WEKA) only accept numerical data to perform the classifier. After that, perform data pre-processing which is data imputation to find out the missing value to maximize the efficiency of the output, rearrange all the data in a correct format so that we can use it in WEKA software to perform the classification. In WEKA, it allow us to use Multi-Layer Perceptron classifier to classify our human motion data. The classification accuracy of the input data ranging from 70 to 97%. Which the higher accuracy of human motion recognition is 97.619% and the motion of the data belong to walking.

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ABBREVIATIONS

2D	Two Dimensional
3D	Three Dimensional
ANN	Artificial Neural Network
ARD	Automatic Relevance Determination
CCTV	Close Circuit Television
CMU	Carnegie Mellon University
GP	Gaussian Process
JAV	Just Another Variable
K3Da	Kinect 3D active
KNN	K-Nearest Neighbor
KTH	Royal Institute of Technology in Stockholm
MEI	Motion Energy Image
MHI	Motion History Image
MLP	Multi-Layer Perceptron
PCOG	Pyramid Correlogram of Oriented Gradients
PMM	Predictive Mean Matching
RBF	Rādial Basis Function
ROI	Region of Interest
SOM	Self-Organizing-Map
SVM	Support Vector Machine
TSA	Tensor Subspace Analysis
VISOR	Image Lab of the University of Modena
WEKA	Waikato Environment for Knowledge Analysis

CHAPTER 1

INTRODUCTION

1.0 Overview

This Chapter introduces the background of human motion recognition and the overfitting problem in real life application. The problems faced by previous researchers are highlighted and the challenges from previous issues that motivated this study are also discussed. In Chapter 1, it writes about the study background of the project, problem statement, and study motivation, objective and research scope.

1.1 Study background

Human motion recognition is an approach which can use to forecast the motion activities form human. Which include dynamic human motion, static body posture, video-based or image-based analysis. Human motion recognition widely used in motion capture and surveillance purposes. Different approaches had been proposed by previous researchers to recognize the motion data correctly. However, overfitting of such approach is still a concern in human motion recognition. Overfitting refers to a system that the system learns the training data too well (Utkin and Wiencierz, 2015). Hence, the aim of this research is to identify the overfitting problem in human motion data and solve by classification approach. This classification approach should be able to learn automatically by setting some rules or algorithm when dealing which different type of motion activities.

1.2 Problem statement

To begin this project, first of all, is understand what is overfitting and how overfitting will happen. The previous researcher using a Naïve Bayesian filter (Androutsopoulos et al., 2000) and K-Nearest Neighbor (KNN) (Wang and Li, 2011) facing overfitting or data missing problem due to uneven distribution in training data.

Overfitting refers to a system that the system learns the training data too well (Utkin and Wiencierz, 2015). By using the artificial neural network (ANN), it can help us to build a recognition function, which this recognition function can recognise a motion for some given input motion data. To able to build such a function, we need to have some training data. If these data too complex and contain too much of error, overfitting will occur.

This is because when ANN learn the detail and noise in the training data and recognise it as a concept for others data. The wrong training data will impact the performance of the predictive function. For example, my project is to recognise the human motion whether the human is walking, running, standing or performing other motion. If the ANN training database had included too much of noise, then the prediction will be terrifying. For example, the wrong prediction of walking as running or wrong prediction of standing as sitting.

1.3 Study motivation

Previous researchers have found that they are hard to treat error (overfitting) that arise from rapid motions within the original video, by referring to the previous researcher Zhou et al. (2017), (Ji et al. (2018), Huang et al., 2007), the human motion recognition efficiency by using different human motion recognition method usually the efficiency are between 70-90%. They also found out the pre-processing method use to correctly impute the missing data at the early stage. By using a different pre-processing method to obtain a human motion data, when doing the human motion recognition, it can prevent the human motion data overfitting thus it can obtain a better human motion matching rate. Besides that, the improvement of the data overfitting can be done by changing the parameter of the classification which can optimize the outcome of the classification data (Bilalli et al., 2017).

1.4 Objective

The objective of this project is to identify the overfitting problem in human motion recognition. A supervised method called ANN had to be applied to solve the problem when various motion activities are involved.

To complete this project, the following work needs to be done:

1. To pre-process the collected raw human motion data.
2. To investigate ANN classifier in solving overfitting problem.
3. To evaluate the performance of the proposed method by comparing the efficiency of the human motion recognition.

1.5 Research scope

In this research, it focuses on marker-based human motion capture data which involving walk, run, jump, wave and crouch. These human motion will be first obtained from human motion database then compare to the recorded motion. The recognition efficiency will be evaluated at the end of the project.

1.6 Report Organization

In this thesis, there are five chapters and the structure is organized as follows.

In Chapter 1, it discussed the study background, problem statement, the objective of this project and research scope of this project.

In Chapter 2, it discussed the different type of human motion recognition method, the different type of data pre-processing method, the different type of classification method, human motion database that needed in this project and the summary of Chapter 2.

In Chapter 3, it discussed the methodology of how to conduct this project. It writes about the method that had to choose from data collection, data pre-processing, classification, and evaluation. The detail of each stage has been discussed in this

Chapter which includes how to transform the data into a numerical form and how to change the parameter of the classifier.

In Chapter 4, it discussed the result of this project, and how the parameter of the classifier that improvement the classifier accuracy.

In Chapter 5, it has shown the conclusion of this project, recommendation to increase the classifier accuracy and future work that need to be done.

CHAPTER 2

LITERATURE REVIEW

2.0 Overview

In Chapter 2, it more focuses on the different literature review on the previous research work and method. In Section 2.1, it discussed motion recognition method. In Section 2.2, it discussed the data pre-processing method. Following by Section 2.3, it discussed the classification method. Section 2.4, will be talked about human motion database. At last Section 2.5, it shows the summary of Chapter 2.

2.1 Human motion recognition method

Human motion recognition method is a method to analyse the human motion by using video or photo that capture by camera or CCTV (Ijjina and Chalavadi, 2017). It also can say that human motion recognition is used to allocate a tag to a motion (Cao et al., 2009). In the aid of Kinovea tools, it helps to transform the video motion into X-Y coordinates along with time.

2.1.1 Human Motion Recognition using Data Mining

Ho et al. (2011) State that when a system obtains movement data from the captured image that is a method call motion recognition by data mining. The system will obtain the coordination of the human hand, shoulder, elbow, head, wrists, pelvis, knees and ankles. Besides that, the time of the image captured also had been obtained. They will represent human motion that happens along with the time as 'Time logs'. By applying all these data in data mining, they can find out the relationship between human intentions versus time logs. They are able to obtain the knowledge from the data which can use as human intention recognition method. The previous researcher (Pujol and García, 2012) also had use data mining method to perform face recognition in their research.