

論 文 内 容 要 旨

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学位論文題目	Emotion Classification and Its Application on Humanoid Robot (感情分類及び人型ロボットへの応用に関する研究)		
<p>In this thesis, the emotion classification based on Ren_CECps and its application on humanoid robot REN-XIN are proposed. "Affective Computing" provided by Picard in 1997, which is of great importance and is computing that relates to, arises from, or deliberately influences emotion or other affective phenomena. The recognition model in our research is trained from a multi-label Chinese emotion corpus annotated by Ren Lab(Ren_CECps). In order to find the complex distributions of every annotated sentences, we be the first group to make a 2D graph using t-SNE(t-Distributed Stochastic Neighbor Embedding) algorithm, and a 3D visualization map is also proposed. To avoid the point overlap, we propose an emotion separated TF.IDF (SeTF.IDF) algorithm to assign one multi-label annotated sentence with different feature vectors for every single category.</p> <p>The 2D and 3D reduced distribution maps gives us a clearer view of the distance within every separated emotion sentence. The points position changed between SeTF.IDF and TF.IDF inspired us to apply a distance measurement algorithm to recognize the emotion categories. We finally propose a fast WMD method which is a 16000 times faster version of Word Mover's Distance(WMD) algorithm. Utilizing the distance features generated by fast WMD method, our experiments show that the SVM classifier get the best F1 scores of 0.318 than the features calculated by SeTF.IDF and TF.IDF of F1 scores of 0.293 and 0.203 respectively. Our cross-language experiments based on Chinese emotional corpus Ren_CECps and English news dataset 20 newsgroup show that with the fast WMD computed features, SVM classifiers get 3 times and 9 times improvement of F1 scores respectively compared with the same dimension features reduced from tradition TF.IDF.</p> <p>Despite the huge progress achieved in robot field, the expression controls of humanoid robot with visual human-likeness face are still manually operated by developer for specified or limited scenarios. With the 'soul' embedded with the emotion recognition model trained with the distance features above, we try to enhance the 'body' of our humanoid robot REN-XIN by improve the expression ability. We utilized the proposed fast WMD method which can recognize nine emotion categories in texts as emotional trigger to generate the corresponding action labels according to the robot's response. For</p>			

the robot system, running the computed basic expression and the voice at the same time, we can get an acceptable humanoid robot interaction with emotion expression.

During the running interaction with Actroid REN-XIN, the fast WMD based emotional trigger system needs at least 7s to deal with the response. To make a real time interaction, the seamless user experience is an essential aspect. Thereby, for people are communicating with humanoid robot, the delayed feedback results to no long communication desire. To solve this rough gap, we propose a CNN+LSTM based DNN model. In the experiments, we utilize the same sub-data sets of the Chinese emotional corpus (Ren_CECps) used in fast WMD experiments used in fast WMD experiments which are split in two ways: one is 50% for training and 50% for testing (1v1 experiment); the other one is 80% for training and 20% for testing (4v1 experiment). The experiments are proceeded in fast WMD, CNN+LSTM, CNN and LSTM respectively. The results show that CNN+LSTM gets the best result of F1 score 0.35 in 1v1 experiment, and almost the same accuracy with fast WMD of F1 scores 0.367 with 0.366 in 4v1 experiment. In the training process, our experiments show that the DNNs only need 3 epochs to finish training. This is not only the difference between minutes and weeks cost in training, but also the extended flexibility for the actroid robot. Our contributes show the CNN+LSTM model has excellent ability for emotion classification and robot control with time sensitive.