521285S Affective computing Exam 26.10.2020

- You may answer in either Finnish or English.

- There are in total 5 questions with 75 points. Please answer all the questions.

- The answers have to be submitted to Moodle by 18:15 at latest.

- The exam points will be scaled based on the performance of all students. So, do everything you can during the two hours!

1. Suppose you are already a researcher in an affective computing research group of University of Oulu, and there is a freshman who just joined your group and has no idea and zero background in this research field. Now, you have to guide him into this research field step by step. (14 points)

a) The first question he holds is that what is affective computing? (2')

b) The second question he holds is that, why do we need an emotion theory for affective computing? (4')

c) Then he starts to study the existing emotion theories, but he finds there are too many and they are complex for him to learn, you tell him that he can distinguish those theories by different aspects (like discrete/continuous, atom/molecule, antecedent/consequent), now the freshman wants to ask you, could you explain the difference and correlation of these theories based on ***at least two*** aspects (e.g. the difference and correlation between discrete/continuous emotion theories)? (4')

d) Your research team wants to develop a ***gesture-based*** emotion synthesis system; they wish you to provide a suitable emotion theory for it. Please choose an existing emotion theory that you think suitable here and illustrate why and how to use this theory to support the desired system. (4')

2. An advertising agency that is doing marketing research has hired you and your team to create a facial-expression recognition system for them. The goal is to detect and recognize the emotional states of subjects who are watching advertisements and to automatically analyze which segments of the advertisements are good and which are bad based on the emotions.

Your task is to give the emotional state of the subject throughout the whole duration of the advertisement. The system is designed from the ground up including data collection and modelling. (18 points)

a) You collect the data in a laboratory setting with a high-quality camera by having participants watch advertisements. Your team members suggest you three different options for the labels: discrete emotions, dimensional emotions or action units. Describe each of the options. Choose one of the options and explain your choice. (3')

b) Your team members are feeling lazy and do not want to label the data, therefore you decide to label the data using crowdsourcing. What things should be taken into account for effective use of crowdsourcing? What problems may occur with labelling affective data? (4')

c) You have now collected and labelled the data, and it is time for modelling. You start with preprocessing, what should be done here and why? (2')

d) Next up is the feature extraction stage. Describe one method that can be used for feature extraction from your data. Why is this step required, why can't we classify the raw images? (3')

e) Last part is the classification. Describe one method that can be used for classification of the extracted features. How can the classification results be evaluated reliably? (3')

f) What other things could be done to improve the system? This may include improvements on the data collection, modelling or both. (3')

3. Multimodal learning/fusion (13 points)

a) Explain the three main categories and limitations of feature-level fusion. (5')

b) We may also perform data normalization before fusion. Let's say we have a training dataset from 10 subjects, and there are 50 samples in total. Each sample is represented by a vector with length of 20. So, when you perform normalization, what is the size of the output standard deviation (SD) matrix from element-wise, sample-wise and subject-wise, respectively. (4')

c) Learning from multiple modalities could improve the performance. Unfortunately, for some cases the data is incomplete. How can we perform Multimodal learning/fusion while there are data missing issues? (4')

4. Facial micro-expressions (12 points)

a) What are the motivation and the challenges of Micro-expression recognition? (4')

b) What is the difference between micro-expression and macro-expression? (3')

c) Except for what you learned from the course, what can be potential research tasks for this topic? Please also briefly introduce why they are important and how we can do that? (5')

5. Open question (18 points)

Suppose you are going to start a new research about affective computing, you are free to choose your own research topics by your personal interests. Please propose your research topic here about affective computing that would like to do and briefly illustrate what might be the potential, current status, challenge of this research topic and your ideas to start it.