2018 COP507 – Computer Vision & Embedded Systems

(This coursework is worth 70% of the module assessment)

Specification

Automatic Number Plate Recognition (ANPR) systems are increasingly being used for managing access control and toll charging. The available systems are steadily increasing in their accuracy and speed of operation making them practically viable in wider domains of applications. Unfortunately vehicle *license plate cloning* has recently been used as a means of breaching the level of security offered by ANPR systems. In license plate cloning, license plates of other registered vehicles are used thus obtaining unlawful access to protected sites, ability to defy identification in general and avoid the payment of toll and other road usage charges. Vehicle Make & Model Recognition (VMMR) will provide an added level of security to ANPR systems by recognising the make and model of the vehicle alongside the license plate so that a validation could be made against the vehicle make and model, thus largely limiting the threat posed by license plate cloning.

In this coursework you are required to design and implement a VMMR system that is capable of recognising a vehicle’s make and model based on a frontal view of the vehicle. Due to limitations of the availability of training data, the system you are required to design will be limited to recognising only twenty five (i.e. 25) vehicle make-models (e.g. make-BMW, model-3 series 2000-2006 facelift). You will be provided with a database of test and training images. Your system will take as input an image of the frontal view of a vehicle (to include the grill, headlights lights, bumper and the license plate) and output the vehicle-make and model. You are required to write a report of not more than 6000 words, discussing the following:

1. Draw the high-level block diagram of your VMMR system (do not include the pre-processing stages) labelling each module/block. Explain the use of each module.

Design the VMMR system justifying your decisions behind the selection of each algorithm/parameter-set etc. Discuss the operation of the overall system. All assumptions made should be clearly listed.

[20 marks]

1. Implement the VMMR system using MATLAB or C/C++. You may use standard implementations/libraries of feature detectors, classifiers etc. However these should be referenced and acknowledged. All code should be provided in softcopy format and should be properly commented.

[30 marks]

1. You are provided with a database of 250 vehicles that includes 10 samples each of 25 vehicle make-models. Use this dataset to prove that your VMMR system is capable of performing as intended. You are required to adopt a cross-validation approach and provide accuracy, precision and recall values in analysing the performance of your algorithm. Discuss your experimental results and analyse the performance of the algorithm proposed.

[25 marks]

1. Assuming that you intend to recognise vehicle car models with deep learning, design a simple Convolutional Neural Network (CNN) and provide a schematic diagram, clearly explain the functions/purposes of each layer in the CNN and discuss the strategies (at least three) to prevent overfitting (note: Its implementation is not required).

[20 marks]

1. If the above software implementation was to be carried out with convolutional neural network, discuss whether the size of the dataset provided is sufficient; if not, discuss possible solutions if time and sources are limited for collecting new data?

[5 marks]

Your submission will include the coursework report and all code in softcopy format. You will also be asked to give a demonstration to the examiners prior to submitting your coursework. This demonstration will not be assessed but will be used as means to identify the student’s contribution and achievement.

Prepared: E.A.Edirisinghe & L.Han, Dec 2018.