Sheffield Hallam University

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College of Business, Technology and Engineering

Course: MSc Big Data Analytics

Module: Programming Concepts and Practice (55-706555)

Assessment 2020/2021 - Semester 2

Coursework II (40%)

1. Introduction

As described in the descriptor, the module will be assessed in two phases of assignments, corresponding to coursework 1 and coursework 2, in line with the module's learning outcomes. The first assignment is linked with the second assignment. This means you cannot execute the tasks in the second assignment without those in the first assignment. Both assignments are individual pieces of work, and your submission consists of implemented modules (containing classes and objects) and a mini-report.

In this assignment, specifically, you will continue with the implementations in assignment 1 but this time using **object oriented programming concepts (OOP) and Python data science libraries** such as numpy, pandas, matplotlib, and scikit-learn.

This assignment assesses the module's learning outcomes (LO) as follows:

- In the first assignment, you focused on designing and implementing python functions and modules for loading and extracting data from datasets and for computing user statistical features for time series data, using an appropriate data structure, string manipulation, iteration, selection, etc.(LO1) based on procedural programming concepts(LO2).
- In this second assignment, you will continue with the implementation of your project by implementing additional functions for segementing the data using sliding window and classfying human activities. You will improve on the previous modules using OOP concepts and Python data science libraries in the human activity recognition domain (LO3).

2. Learning Outcomes (LOs)

I. Selecting appropriate programming techniques and data structures to develop effective software implementations of relatively complex systems using an appropriate programming language such as Python, Java or C#.

II. Applying relevant program design strategies to the implementation of software applications using that programming language.

III. Designing and implementing well-engineered, domain specific software using that programming language

3. Getting Started and General Specifications

The following tasks are to be performed in this assignment:

I. Implementation using OOP Concepts.

In this task, you will **MODIFY** and **IMPLEMENT** the first and the second modules of assignment 1 using OOP concepts. This means implementing your solution of assignment 1 as classes and methods.

II. Data Segmentation using sliding windows

In this task, you will include one additional method. This method will provide the functionality for data segmentation process using sliding window algorithm with 50% overlapping.

III. Classification Algorithms

You are required to use classification algorithms such as Neural networks, Naïve Bayes, Random Forest, Support Vector Machine, Logistic Regression and K-Nearest Neighbours from the python scikit-learn library to classify human activities using the provided labelled dataset. You must implement and evaluate at least **three** classification algorithms.

[Hint: target/class variable is the "activity"]

IV. Evaluation

You are required to evaluate the classification algorithms performances using evaluation metrics such as accuracy. You are to plot the graph of the human activity recognition accuracies for the used algorithms and thus, detail the algorithm with the highest accuracy.

V. Mini Report

You will write a well-structured report not more than 5 pages, summarising your designs, implementation decisions, justifications, and your class diagrams expressing the relationships among objects of your application. You should provide figures representing the architecture of your system as well as flow diagram of the functionality of your application. Also include a section on reflection of your experience implementing this application.

4. The Dataset

The datasets for this assignment is the same dataset used in the first assignment. Therefore, details of the datasets will not be repeated in this document. If you have any doubts check the first assignment for details of the datasets on Blackboard.

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5. Pay attention to the following requirements

This assignment is an individual piece of work, and your submission must be in the form of modules (.py files) or Jupyter Notebook file. We should be able to open and run your modules on a standard campus computer.

a) You will submit a mini- report. The report should provide justifications for your analysis of the solution, design decisions especially on the object oriented design. It should explain the relationships between the classes and objects. A good report should be based on evidence with critical analysis of the implemented system. Even if your application does not work correctly, you should still submit the mini-report explaining what you have done, what works and what has not worked.

b) Any evidence of collusion/plagiarism will be penalised if appropriate! If there is some doubt about the authenticity of a particular piece of work, then the person submitting it will be expected to defend such work, including reasons for the programming decisions taken. You must document with references any use of libraries or existing code in your mini-report.

c) This assignment is linked to assignment 1. This means that assignment 2 is a continuation of assignment 1.

d) Appropriate use of variable names for clearer understanding is desirable

e) Adequate commenting of your codes for easier understanding during grading is also desirable.

f) **Note that creativity will be rewarded** for a well-implemented system that goes the extra-mile to achieving the required functionality and doing something more creative above the given specifications. Such creative, additional functionality could a be a user friendly GUI and should be justified in a separate section in your mini-report, check the assessment grid for details. An example could be an implementation of a user friendly GUI for your application.

6. Submission Process

Your assignment should be submitted electronically through the module's Blackboard site as a single ZIP file that contains all your source codes and mini-report. Check your upload to ensure you have submitted the correct files successfully as any issues will not be considered after the deadline. You are required to provide an explanation in your mini-report on how to execute your application.

7. Submission Deadline

Tuesday, May 18th, 2021, 2:59 pm

8. Assessment Criteria

This coursework will be assessed mainly by the **quality of the report, code testing, inspection, and live online demonstration of the submitted codes.** During the online

live demo, you will be asked questions based on the learning outcomes and the assessment criteria. Therefore, the coursework will be assessed against the Learning Outcomes (LOs) using a set of assessment criteria. This set of assessment criteria allows assessing how successful you have met the LOs. To ensure consistent use of the relevant criteria, the assessment criteria are summarised in the following assessment matrix and grid. This is an indicator of how the marks will scale across each category of the learning outcomes it covers.

Assignment	Assessment Criteria	Marks	Learning Outcomes		
			LO1	LO2	LO3
Assignment 2	Definition and application of basic OO programming(classes and objects) concepts (/15)	15%	x	x	X
	Clear understanding definition and use of method, method parameters and arguments (/10)	10%	x	x	X
	Use of python libraries (/10)	10%			X
	Quality and usefulness of the submitted mini-report (/5)	5%			X

9. Assessment Rubric

Fail (<50%)	Pass(50-59)	Merit(60-69)	Distinction (70% +)
Definition and application of basic OO (classes, objects, inheritance, etc.)programming concepts (15%)			
No evidence of understanding of basic object oriented programming concepts such as classes, methods and objects. Application crashes, etc. No submission	Some evidence of understanding and application of OOP but only partial understanding of appropriate ones to develop programming solutions. Some issues such as naming conventions for objects, etc.	Very good understanding of OOP concepts, for developing working solution. Some minor issues of correctness.	Exceptional and creative exploration of OOP concepts, very clear identification of the most appropriate approach with justifications.
Clear understanding definition and use of method, method parameters and arguments . (10%)			
No evidence of understanding and use of parameter and argument passing. Nothing is submitted.	Evidence of clear and consistent understanding of the method definition and application. Evidence of practical solution.	Very good and appropriate definition of methods, parameters and argument passing. Very good understanding of the relationship between classes methods and attributes	Exceptional understanding and creative use of the class methods of programming solutions.
Use of python libraries (10%)			

No evidence of the use of Python libraries such as numpy or pandas. Not able to apply appropriate python libraries. No submission	Clear and good evidence of the use and application of python libraries with some correct and expected outputs. But some minor issues with outputs.	Very good understanding and good implementation using python libraries to implement some of the functionality of the system with justifications and correct outputs. Program executes and produces expected	Excellent under tanding and implementation of relevant python libraries, such as numPy , pandas, matplotib and scikit-learn with outstanding results. excellent user interaction through GUI, etc.
Quality and usefulness of the submitted mini-report (5%)			
Unclear structure, poor report and presentation. Inaccurate information. Poor use of language. Little or incorrect referencing.	Clear, well structured, concise and accurate presentation. Sources are correctly referenced. Minor issues of language, etc.	Very good use of language and style. Clear evidence of professional practice and presentation.	Exceptional report and presentation of work done. Evidence of exceptional understanding of the developed system. Report provides very good insight into the developed systems.

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***All work must be your own**. If evidence of collusion/copying is found, then **such collusion will be penalised, severely if appropriate!** If there is some doubt about the authenticity of a particular piece of work, then the person submitting it will be expected to give a detailed explanation of such work, including reasons for the programming decisions taken.*

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References

1. A. Bulling, U. Blanke, B. Schiele, "A tutorial on human activity recognition using body-worn inertial sensors", *ACM Computing Surveys (CSUR)*, vol. 46, no. 3, pp. 33, 2014.
2. Otebolaku, A.M., and Andrade, M.T. "User context recognition using smartphone sensors and classification models", J. Netw. Comput. Appl., 66 (2016), pp. 33-51

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Table 4: Level 7- Generic grade descriptor: relationship of grades of achievement to percentage mark ranges and categorical grades (CG)

Class	Mark range	CG %	General Characteristics
DISTINCTION (Excellent)	93 - 100	96	Exceptional breadth and depth of knowledge and understanding evidenced by own independent insight and critical awareness of relevant literature and concepts at the forefront of the discipline; evidence of extensive and appropriate independent inquiry operating with advanced concepts, methods and techniques to solve problems in unfamiliar contexts; Cogent arguments and explanations are consistently provided using a range of media demonstrating an ability to communicate effectively in a variety of formats using a sophisticated level of the English language in an eloquent and professional manner to both technical and non-technical audiences; a sustained academic approach to all aspects of the tasks is evidenced; academic work extends boundaries of the disciplines and is beyond expectation of the level and **may achieve or be very close to publishable or commercial standard**.
	85 - 92	89	Excellent knowledge and understanding **evidenced by some clear independent insight and critical awareness of relevant concepts some of which are at the forefront of the discipline**; evidence of appropriate independent inquiry operating with core concepts, methods and techniques to solve complex problems in mostly familiar contexts; Arguments and explanations are provided that is well-supported by the literature and in some cases uses a range of media demonstrating an ability to communicate effectively in a limited number of formats using own style that is suited to both technical and non-technical audiences; a sustained academic approach to most aspects of the tasks is evidenced; **one or more aspects of the academic work is beyond the prescribed range** and evidences a competent understanding of all of the relevant taught content.
	78 - 84	81	
	70 - 77	74	
MERIT (Good)	67 - 69	68	Very good knowledge and understanding is evidenced as the student **is typically able to independently relate taught facts/concepts together some of which are at the forefront of the discipline**; evidence of some competent independent inquiry operating with core concepts, methods and techniques to solve familiar problems; Arguments and explanations are provided that are typically supported by the literature and in some cases may challenge some received wisdoms; competently uses all taught media and communication methods to communicate effectively in a familiar settings; an academically rigorous approach applied to some aspects of the tasks is evidenced; some beyond the prescribed range, may rely on set sources to advance work/direct arguments; demonstrates autonomy in approach to learning.
	64 - 66	65	
	60 - 63	62	

PASS (Satisfactory)	57 - 59	58	Good knowledge and understanding of the area of study **balanced towards the descriptive rather than critical or analytical and mostly confined to concepts that are not at the forefront of the discipline**; evidence of some independent reading and research to advance work and inform arguments and approaches; Arguments and explanations are limited in range and depth although some are adequately supported by the literature albeit descriptively rather than critically; competently uses at least one taught media and communication method to communicate appropriately in familiar settings; although the approach applied to some aspects of the tasks may lack academic rigour, there are some clear areas of competence within the prescribed range. Relies on set sources to advance work/direct arguments and communicated in a way which shows clarity but structure may not always be coherent.
	54 - 56	55	
	50 - 53	52	
FAIL (Insufficient)	40 - 49	45	**Knowledge and understanding is marginally insufficient as the student is typically only able to deal with terminology, basic facts and concepts**; Adequate knowledge of concepts within the prescribed range but fails to add meaningful detail or make sufficient links between concepts and facts to adequately solve problems posed by the assessment; some ability to independently select and evaluate reading/research however there is a strong reliance on set sources and to provide descriptive and unsubstantiated arguments/methods; communication/presentation is competent in places and at a threshold level as it fails to demonstrate clarity and focus; inability to adequately define problems and make reasoned judgements; The general approach to tasks lacks rigor and where there is competence and rigor, it is not sustained.
	30 - 39	35	
	20 - 29	25	**Knowledge and understanding is highly insufficient as the student is unable to evidence any meaningful understanding of two or more taught concepts or methods**; very limited evidence of reading and research to advance work; inadequate technical and practical skills as the student is unable to use and apply such skills to address problems or make judgements; limited or lack of understanding of the boundaries of the discipline and does not question received wisdom; approach to learning lacks autonomy and approach to tasks is not sustained; inability to communicate coherently.
	10-19	15	
	1-9	5	
ZERO	0	0	Work of no merit OR absent, work not submitted, penalty in some misconduct cases.