

Department of Electronic & Electrical Engineering

MEng/BEng in CES EE475 Individual Project

This document is organised in to four parts:

PART 1: STATEMENT OF INTENT
PART 2: PROJECT WORK PLAN
PART 3: RESOURCE REQUIREMENT
PART 4: RISK ASSESSMENT
PART 5: SAFETY DECLARATION

- All parts of the form must be completed jointly by the student and Project Supervisor, and lodged (by the student) in R4.01(EEE Resource Centre) by 13.30 on 20th October 2016.
 - Copies of the completed form will be sent to the Project Supervisor and Second Assessor.
 - The student is advised to retain a copy of the completed form for future reference.
 - Students will be asked to reflect upon parts 1, 2 and 4 in the interim reports and also in the final report.
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Supervisor's Name: Dr Marc Roper	Student's Name: R. David Dunphy
Project Title: Applying machine learning techniques to the classification of classical orchestral music	

PART 1: STATEMENT OF INTENT

The purpose of this section is: (i) to provide a concise description of the project, and (ii) to state a set of objectives that will provide the guide for assessing the project. Students should note the importance of item (ii), which should be discussed in detail with their project supervisors.

A. Project Description:

The student, in consultation with the Project Supervisor, is required to describe the project in his/her own words in the space provided below (in about 200 to 300 words). Note that simply copying descriptions in the project listing is unacceptable. THIS PART SHOULD NOT BE COMPLETED BY THE PROJECT SUPERVISOR other than ensuring the accuracy of the description. DO NOT ATTACH EXTRA PAGES.

People familiar with classical music are frequently able to identify the composer of an unknown piece of music when hearing it for the first time, based solely on stylistic features. The aim of this project is to create a computer program capable of replicating some of this ability. Sound recordings of orchestral music from the 17th to 20th centuries will be analysed in order to identify useful features, and then classified using supervised learning techniques. To begin with, compositions will be classified by compositional period (e.g. Baroque, Romantic, etc.). If this is successful, the application will be extended to try and identify the composer of a given piece of music.

Supervised learning algorithms require a large amount of training and test data. The first step of the project will be to assemble and label an appropriate database of extracts.

A key part of the project will consist of determining which features are helpful for classification, and how to extract these features from the raw sound data. Possible features might include the timbre of the instruments, harmonic density, or tonality. There is a substantial amount of existing research in this area which can be drawn upon. These features will be used in an attempt to classify musical extracts using traditional machine learning algorithms such as k-nearest neighbours.

Musical extracts will then be analysed using a more advanced deep learning algorithm. Techniques will need to be explored to determine how to apply algorithms such as convolutional neural networks to the domain of music. Finally, the performance of different algorithms will be evaluated and compared.

B. Project Objectives:

Project objectives must be stated in such a way that they can be translated into achievable goals during the conduct of the project. For this reason, the stated objectives must be specific and realistic to be attained within the time provided. It will be very helpful if supervisors encourage their students to come up with initial objectives from students' perspective as this exercise could help students to better understand the aims of the project. It is important to note that the achievements of the project work will be measured against the objectives stated here. Copies of this section will be made available to persons involved with the assessment of this project.

To Project Supervisor:

1. Under the "Importance" column below, enter one of the following as appropriate: "Major", "Minor", or "Optional".
1. If at a later stage the project objectives change significantly from those stated here, the changes must be communicated to the Second Assessor. Please make a copy to the Year Co-ordinator, Dr D. Harle.

Project Objectives	Importance
Review existing research into classification in musicology, and identify suitable techniques and technologies	Major
Analyse musical extracts in order to identify features	Major
Create an application capable of classifying music by composition period using a deep learning algorithm	Major
Compare the performance of deep learning algorithms to traditional machine learning algorithms	Minor
Extend the application to identify composers	Optional

PART 2: PROJECT WORK PLAN

Identify project milestones and summarise your work plans in the table below in the order you do them. (Example: preliminary design, prototyping, simulation modelling, results validation, write-up, etc.).

	Project Milestones/Work Phases	Expected Week Time Enter start and end week Ex.: Week 6 to week 8
1	Research into existing technologies and techniques	Weeks 11 to 18
2	Assembly of training and test sets	Weeks 12 to 20
3	Application of conventional machine learning techniques	Weeks 15 to 28
4	Application of deep learning techniques	Weeks 22 to 33
5	Evaluation of results and report writing	Weeks 29 to 35

PART 3: RESOURCE REQUIREMENT

A. Software:

List the software required for the project. This includes programming languages, application packages, CAD tools, etc.

Software (indicate version no. if applicable)	Software Administrator (CS Dept, EEE Dept, Comp. Centre)	Target Use (teaching, research, etc.)	Platform (PC, workstation)	Expected Usage (hours/week)
PyCharm / Python	N/A	Development	PC	15

B. Hardware:

List major hardware components such as circuit boards, LSI/VLSI integrated circuits, and special purpose components.

In the event that training the algorithms proves to be computationally expensive, additional GPUs or the use of a cloud computing service may be required.

C. Laboratory/Work Area:

Indicate the laboratory room(s) and/or project work area for the project.

N/A

D. Logbook:

Confirmation that student has A4, hardback, bound logbook that has been viewed by the supervisor.
YES

PART 4: TECHNICAL RISK

Management of project work requires that technical risk be assessed in advance, during initial planning and as an ongoing process. As the first stage to this process, identify any aspects of risk associated with your project proposal. Risk in this context is taken to mean any event or action (or inaction) that would jeopardise any project outcomes or significantly impede project progress. Furthermore having identified such potential risks, indicate what actions you would take to mitigate the effects of this risk. (Consult your supervisor for advice but examples of such risks include non-delivery of a key component, illness or absence from University, non-completion by student or other of key deliverable, equipment malfunction, extended learning curves- new techniques or software, etc.).

	Possible Risk:	Mitigating Action:
1	Extended learning curve due to high number of algorithms and concepts to be understood	Allow extended research period in first semester and find appropriate resources online and in print
2	Training algorithms may require more time than anticipated	Start training early on and acquire additional hardware resources if necessary
3		
4		
5		

PART 5: SAFETY DECLARATION

All project students must be aware of the need for safe working during the conduct of their project. The Area Safety Regulations for the Department of Electronic and Electrical Engineering, which appear in the Undergraduate Handbook, provide general guidance. Project students should consult with their Supervisor to obtain specific instructions or written Risk Assessment relating to their own project. By signing at the end of this form, the project student is declaring that:

1. he/she has attended the EEE UG Individual Project safety seminar.
2. he/she has completed the online safety assessment quiz
3. he/she has read and understood the Area Safety Regulations and will abide by these regulations during the conduct of the project, and
4. he/she has consulted with the Project Supervisor who, if applicable, has specified the additional Risk Assessment or additional Safe Systems of Work and Standard Operating Procedures which is as stated below:

(enter NONE if not applicable)

None

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Signature of Student

Date

Signature of Supervisor

Date