University of Manitoba

Department of Electrical & Computer Engineering
Graduate Course Outline

FALL 2021

ECE 7440 T73– Feature Extraction and Feature Selection for Machine Learning Classification

COURSE DESCRIPTION:

The course main two areas are i) extraction of features from one dimensional and two dimensional data and ii) feature selection methods to identify the most important features to be used on classification algorithms. The course studies the pre-processing and analysis of data in order to formulate the best features that can improve classification results as well as different state of the art feature selection methods.

COURSE OBJECTIVE:

The course objective is to study the importance of feature extraction and feature selection as well as to study some of the classical and newer techniques that accomplishes both tasks. As good features can highly affect the classification accuracy of a system independently of the classification method, the course offers a deeper discussion on these topics. Through different examples, the student will acquire knowledge on what type of features can yield the best classification outcomes, how to extract them and how to evaluate them.

PRE-REQUISITES:

Undergraduate background in digital signal processing, statistics.

CONTACT HOURS:

3-hours per week Tuesdays and Thursdays at 11:30 am

COURSE CONTENT:

The following topics will be discussed:

- Data collection: hardware considerations, sampling, scaling and data whitening.
- Decision boundaries: brief introduction to common classification methods.
- Features from one dimensional data.
- Features from two dimensional data.
- Feature selection methods: embedded, wrapper and filter methods.
- Combining methods: voting.

HOMEWORK:

Homework will consist of five Matlab assignments and theoretical problems.

TEXTBOOK:

Class notes.
Reference: Pablo Duboue, The Art of Feature Engineering, Essentials for Machine Learning, Cambridge University Press, 2020.

EVALUATION:

Your final course grade is determined by your performance in the components list below in the Evaluation Table (seminar, assignments, project, mid-term, and a final examination. Students must receive a minimum of 50% on the final examination and must complete and pass all components in the course in order to be eligible to receive a passing grade.

Each component is weighted as follows:

COMPONENT	NO	VALUE %	TOTAL VALUE	DETAILS / ADDITIONAL INFO
Projects/assignments	5	15%	75	
Final Examination	1	25%	25	
TOTAL			100	

GRADE SCALE:

LETTER	MARK	LETTER	MARK	LETTER	MARK	LETTER	MARK
A+	95-100	B+	80-84	C+	65-69	D	45-54
A	85-94	B	70-79	C	55-64	F	<45

INSTRUCTOR INFO:

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Office Hours: ..... By appointment

VOLUNTARY WITHDRAW:

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REQUIREMENTS/REGULATIONS

Student Responsibilities: It is the responsibility of each student to contact the instructor if he/she is uncertain about his/her standing in the course and his/her potential for receiving a failing grade. Students should also familiarize themselves with Sections 4 and 6 of the Regulations dealing with, among others, incomplete term work, deferred examinations, attendance and withdrawal, etc..

Lectures: Attendance at lectures is essential for successful completion of this course. Students must satisfy each evaluation component in the course.

ACADEMIC INTEGRITY

Students are expected to conduct themselves in accordance with the highest ethical standards of the Profession of Engineering and evince academic integrity in all their pursuits and activities at the university. As such, in accordance with the General Academic Regulations and Requirements of the University of Manitoba, Section 7.1, students are

reminded that plagiarism* or any other form of cheating is subject to serious academic penalty (e.g. suspension or expulsion from the faculty or university) regardless of media

- examinations
- assignments
- laboratory reports
- term exams

A student found guilty of contributing to cheating in examinations or term assignments is also subject to serious academic penalty

Please refer any questions regarding Academic Integrity to your course instructor.

***Plagiarism:** to steal and pass off (the ideas or words of another) as one's own; use (another's production) without crediting the source