EE565 Pattern Recognition and Machine Learning (3 credits)
Fall 2016
Klipsch School of Electrical and Computer Engineering
College of Engineering
New Mexico State University

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**Instructor and Class Information**
Instructor: Prof. Phillip De Leon, Goddard Annex 160G; (575) 646-DSP1 (3771); pdeleon@nmsu.edu
Class Days and Times: Tu, Th 10:20 – 11:35am, T&B 303
Office Hours: M 1:30 – 2:30pm, Tu 1:30 – 2:30pm, and by prior appointment

**Course Description from the Graduate Course Catalog**
Statistical pattern classification supervised and unsupervised learning, feature selection and extraction, clustering, image classification and syntactical pattern recognition.

**Prerequisite**
Recommended preparation is EE210 or equivalent probability and statistics and linear algebra courses. Students must have programming competency in MATLAB, Python, or other language appropriate for PRML.

**Textbook**
*Pattern Recognition and Machine Learning* by Christopher Bishop, Springer, 2007 (ISBN 978-0387310732)

**Computing Resources**
Students may use the computing laboratory located in T&B 202. The lab is equipped with PCs and MATLAB.

**Online Resources**
EE565 Web Page
http://wordpress.nmsu.edu/pdeleon/teaching/ee565/

Course announcements will be posted to Canvas
http://learn.nmsu.edu

Note: Please do not email Prof. De Leon through Canvas--use the email address listed above.

**Course Objectives**
The objective of this course is to gain an understanding of the methods used in PRML:

- Density estimation methods
- Linear models for regression and classification
- Neural networks and kernel methods
- Support Vector Machines (SVMs) and Relevance Vector Machines (RVMs)
- Graphical models and clustering
- Mixture models and expectation maximization (EM)
- Principal component analysis (PCA)

This objective is achieved through a graduate-level treatment of pattern recognition and machine learning including both theoretical and experimental work.

**Contribution of EE565 to Meeting the Professional Component**
Pattern recognition and machine learning is an elective course for specialization in Digital Signal Processing. Students in EE565 will apply techniques learned in class through problem solving, software development, and in-class discussions. Such a treatment will greatly assist students in understanding research articles in journals such as the *IEEE Transactions on Pattern Analysis and Machine Intelligence* and also to conduct independent research. Class provides 3 credits of engineering science credit

**Relationship of the Course to Program Objectives**
Pattern recognition and machine learning provides a foundation for advanced level study in Digital Signal Processing. This will allow students to further explore their graduate specialty and perform independent research.

**Americans with Disabilities Act/Office of Institutional Equity (ADA/OIE)**
Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act (ADA) covers issues relating to disability and accommodations. If a student has questions or needs an accommodation in the classroom (all medical information is treated confidentially), contact:

Trudy Luken
Student Accessibility Services (SAS) - Corbett Center Student Union, Rm. 208
Phone: (575) 646-6840 E-mail: sas@nmsu.edu | Website: http://sas.nmsu.edu/

**Policy Statement on Equal Employment Opportunity and Affirmative Action**
NMSU policy prohibits discrimination on the basis of age, ancestry, color, disability, gender identity, genetic information, national origin, race, religion, retaliation, serious medical condition, sex, sexual orientation, spousal affiliation and protected veterans status. Furthermore, Title IX prohibits sex discrimination to include sexual misconduct: sexual violence (sexual assault, rape), sexual harassment and retaliation.

For more information on discrimination issues, Title IX, Campus SaVE Act, NMSU Policy Chapter 3.25, NMSU's complaint process, or to file a complaint contact:

Lauri Millot, Director and Title IX Coordinator
Agustin Diaz, Associate Director, Title IX Deputy Coordinator
Office of Institutional Equity (OIE) - O'Loughlin House, 1130 University Avenue
Phone: (575) 646-3635 | E-mail: mailto:equity@nmsu.edu| Website: http://eeo.nmsu.edu/

**Grading**
*Regular Projects* (80%) - There will be six regular projects requiring development of software for pattern recognition and machine learning. Each regular project will include a short (3-5 pages) technical report. Each regular project is worth 13.3% of the final grade.

*Final Project* (20%) - Each student will develop one final project in the course worth 20% of the final grade. Included in the final project grade is a proposal, technical report, and presentation.

*Final Grade* - The final grade will be assigned as follows (we reserve the right to lower the grade ranges for particular letter grades but will never raise the grade ranges)

| | | | |
|---|---|---|---|
| A+ | >100% | C+ | 79 – 76% |
| A | 100 – 95% | C | 75 – 73% |
| A– | 94 – 90% | C– | 72 – 70% |
| B+ | 89 – 86% | D+ | 69 – 66% |
| B | 85 – 83% | D | 65 – 63% |
| B– | 82 – 80% | D– | 62 – 60% |

**Policies**

The College of Engineering has a "2 strikes and you're out" policy for academic misconduct. This means that a student will be suspended after found guilty of two academic misconduct cases. Suspension means out for one year. A strike can count from academic misconduct occurring in any college. The NMSU Student Code of Conduct can be found at:

http://studenthandbook.nmsu.edu/student-code-of-conduct/academic-misconduct/

Additional regulations may be found in the catalog regulation section

http://nmsu.smartcatalogiq.com/en/2016-2016/Undergraduate-Catalog/General-Information/Regulations

and in the college of engineering section

http://nmsu.smartcatalogiq.com/en/2016-2016/Undergraduate-Catalog/College-of-Engineering

The latest online catalog information from these sections, in addition to this syllabus, serve as your contract with the College of Engineering.

Disputes regarding project grades must be submitted in writing to Prof. De Leon for review within 7 days after graded work has been returned or posted.

As a courtesy to the instructor and fellow students, please TURN OFF your cell phones. Any student who disrupts class due to the use of an unwelcomed electronic device will be asked to leave.

**Recording/Streaming Lecture**

Lectures may be recorded or streamed live (Livestream, Meerkat, Periscope), however, commercial use is strictly prohibited.

**Topics Covered / Course Schedule**

The topics covered and course schedule are described in the Course Schedule section of this syllabus.

**Prepared**

Phillip De Leon, 17 August 2016.

# EE565 Fall 2016 Course Schedule

This schedule is an estimate of the topics covered each week throughout the course. The following chapters are from *Pattern Recognition and Machine Learning* by Christopher Bishop, Springer, 2007 (ISBN 978-0387310732)

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**Week 1 August 14, 2016**

Chapter 1: Introduction

**Week 2 August 21, 2016**

Chapter 1: Introduction

**Week 3 August 28, 2016**

Project #1 due Sep. 1
Chapter 1: Introduction

**Week 4 September 4, 2016**

Chapter 1: Introduction
Chapter 2: Probability Distributions

**Week 5 September 11, 2016**

Project #2 due Sep. 15
Chapter 2: Probability Distributions

**Week 6 September 18, 2016**

Chapter 2: Probability Distributions
Chapter 9: (Gaussian) Mixture Models and EM

**Week 7 September 25, 2016**

Project #3 due Sep. 29
Chapter 3: Linear Models for Regression

**Week 8 October 2, 2016**

Chapter 4: Linear Models for Classification

**Week 9 October 9, 2016**

Project #4 due Oct. 13
Chapter 5: Neural Networks

**Week 10 October 16, 2016**

Oct. 20 Final project proposal due
Chapter 6: Kernel Methods

**Week 11 October 23, 2016**

Project #5 due Oct. 27
Chapter 7: Sparse Kernel Machines

**Week 12 October 30, 2016**

Chapter 7: Sparse Kernel Machines

**Week 13 November 6, 2016**

Project #6 due Nov. 10
Chapter 9: k-Means Algorithm

**Week 14 November 13, 2016**

Deep Learning

**Week 15 November 20, 2016**

*Thanksgiving Break!* (no classes)

**Week 16 November 27, 2016**

Final project due Dec. 2

**Week 17 December 4, 2016**

Final project presentations
Tuesday, Dec. 6, 3:30pm – 5:30pm
Wednesday, Dec. 7, 3:30pm – 5:30pm
Thursday, Dec. 8, 10:30am – 12:30pm