

4 problems with multiple sub-questions 计算题 + concept 问答题

## Review guideline for Midterm Exam of ESE417 FL2024

Midterm Exam is schedule in 11/21/2024 (Thursday) during the regular meeting time (11:30AM~12:50PM). You must come to the classroom to take the exam (if you don't have an appointment with the DR office).

The following topics and concepts may be covered in this exam:

### Topics:

- Regression *linear, polynomial, ridge, MLE, MAP*
- Gradient Descent Search Method
- Perceptron model
- Logistic regression model
- Support Vector Machine (SVM) model
- Artificial Neural Networks model
- Backpropagation training algorithm
- K Nearest Neighbor method *x training process*
- Naïve Bayes classifier *generative model*
- Decision Trees *x have objective function*

*multi-layer perceptron*

*feature conditional independent*

### Concepts:

- Training set, test set and validation set *why? 调整超参数*
- Bias-Variance tradeoff *definition*
- Overfitting and underfitting models *Small dataset  $\rightarrow$  complex model*
- Cross-validation and hyperparameter tuning
- Regularization *important*
- Batch training vs sequential (stochastic) training *perceptron model*
- Margin of a hyperplane *largest margin SVM*
- Structure of the feedforward neural networks (multilayer perceptron model)
- Expressive power of ANN *activation function - non linear*
- Metrics in K nearest neighbor classification *distance*
- Curse of dimensionality

There will be calculations on given data sets in the exam. No Python programming is needed.

This exam is open-book, open-notes. Access to the reference books, class notes, and lecture slides are allowed. If you want to use your laptop computer or iPad for access to the notes and lecture slides, you must download those documents before the exam. You are encouraged to prepare a few pages of cheat sheet to be used during the exam. You may use a calculator. No access to Internet is allowed during the exam except submit your work on Canvas. No use of a cellphone is allowed during the exam.

Hard copy of the exam will be distributed in the classroom. The exam paper will not be available on Canvas. However, you need to submit your work as a pdf file to the "Midterm" exam assignment on Canvas.

## Module 1-8

Module 1 Introduction and Review

Module 2 Regression

Module 3 Training, testing, generalization

Bias-Variance decomposition and Overfitting

Module 4 Classification and performance evaluation

Perceptron

Logistic Regression

Module 5 Support Vector Machine (SVM)

Module 6 Artificial Neural Networks (ANN)

Module 7 K nearest neighbor (KNN)

Naive Bayes classifier

Module 8 Decision Trees

Random Forest model