

# **Data Mining**

## **Final Term Project**

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# CS 634 Final Term Project

- This is a single person project.
- On the first page of the project report, indicate your first name, last name, NJIT UCID, preferred email address, and the option number you choose (otherwise you will lose points).
- There are six options. You choose one of the six options.

# Submission Rules

- Submit ONE SINGLE file. Embed your last name, first name and option number in your project file name. For example, if your name is John Smith, and you choose option 1, then your file name should read: smith\_john\_finaltermprojoption1.doc. Only doc or pdf file is accepted. No tar/zip/rar is allowed.
- Your final term project will automatically lose **10** points if the above submission rules are violated.
- Submit your final term project file in Canvas under Final Term Project Submission Site before the deadline.
- **NO LATE PROJECT IS ACCEPTED.** Submit your project to Canvas before the deadline even if it is not complete. If it is not complete, on the first page of the project, provide a note to indicate what you have completed and what is missing. All projects emailed to me or TA will be ignored.

# Final Term Project: Option 1

## Supervised Data Mining (Classification)

- This option is to implement 2 classification algorithms of your choice on 1 dataset of your choice (each of the 2 algorithms must run on the dataset).
- Your final term project documentation must indicate clearly the algorithms and dataset you used in the project.

# Final Term Project: Option 1

## General Sources of Algorithms/Software

[http://davidmlane.com/hyperstat/Statistical\\_analyses.html](http://davidmlane.com/hyperstat/Statistical_analyses.html)

<http://statpages.org/javasta2.html>

<http://pcp.sourceforge.net/>

<http://www.cs.waikato.ac.nz/ml/weka/>

<http://waffles.sourceforge.net/>

<http://www.r-project.org/>

<http://mlflex.sourceforge.net/>

<http://cran.opensourceresources.org/>

Han Book 3<sup>rd</sup> ed Chapters 8, 9

Kumar Book 1<sup>st</sup> ed Chapters 4, 5

# **Final Term Project: Option 1**

## **Specific Algorithms and Tools used in the Project**

- There are 5 categories of algorithms listed on the following pages (categories 6-10 are software tools and platforms). The 2 classification algorithms you choose must come from two different categories. In the same category, only one algorithm can be chosen from that category.
- In your final term project documentation, for each algorithm you choose, specify clearly the category number/name and algorithm name in that category.

# Category 1 (Support Vector Machines)

- LIBSVM (<http://www.csie.ntu.edu.tw/~cjlin/libsvm/>)  
linear kernel
- LIBSVM polynomial kernel
- LIBSVM radial basis function (RBF) kernel
- LIBSVM sigmoid kernel
- SVM light (<http://svmlight.joachims.org/>) Pick a kernel of your choice and specify the kernel used in your project
- Gist (<http://www.chibi.ubc.ca/gist/>) Pick a kernel of your choice and specify the kernel used in your project

## Category 2 (Random Forests)

- CRAN (<http://cran.r-project.org/web/packages/randomForest/index.html>)
- Willows (<http://c2s2.yale.edu/software/Willows/>)
- Weka  
(<http://weka.sourceforge.net/doc/weka/classifiers/trees/RandomForest.html>)



# Category 3 (Decision Trees)

Refer to Weka

<http://weka.sourceforge.net/doc/weka/classifiers/trees/package-summary.html>

<http://www.cs.waikato.ac.nz/ml/weka/>

- ADTree
- J48 (C4.5)
- LMT
- M5P
- NBTree

# Category 4 (Bayesian Networks)

- Weka BayesNet

<http://weka.sourceforge.net/doc/weka/classifiers/bayes/package-summary.html>

<http://weka.sourceforge.net/doc/weka/classifiers/bayes/BayesNet.html>

[http://www.cs.waikato.ac.nz/ml/weka/index\\_related.html](http://www.cs.waikato.ac.nz/ml/weka/index_related.html)

<http://www.cs.waikato.ac.nz/~ml/weka/index.html>

- JBNC (<http://jbnc.sourceforge.net/>)

# Category 5 (Naïve Bayes)

Refer to Weka:

<http://weka.sourceforge.net/doc/weka/classifiers/bayes/package-summary.html>

- AODE
- ComplementNaiveBayes
- NaiveBayes
- NaiveBayesMultinomial
- NaiveBayesSimple
- NaiveBayesUpdateable

## Category 6 (R Package)

- Refer to

<http://www.r-project.org/>

Pick any classification tool in R.

## **Category 7 (Mathematical Package)**

- MATLAB available at NJIT

# Category 8 (RapidMiner)

[www.rapidminer.com](http://www.rapidminer.com)

<http://sourceforge.net/projects/rapidminer/>

# Category 9 (Weka)

<https://www.cs.waikato.ac.nz/ml/weka/>

# Category 10 (Python)

<https://scikit-learn.org/>



# Final Term Project: Option 1

## Sources of Data

<http://archive.ics.uci.edu/ml/>

<http://mlr.cs.umass.edu/ml/machine-learning-databases/>

[http://www.cs.ucr.edu/~eamonn/time\\_series\\_data/](http://www.cs.ucr.edu/~eamonn/time_series_data/)

<http://aws.amazon.com/datasets>

[http://www.trustlet.org/wiki/Repositories\\_of\\_datasets](http://www.trustlet.org/wiki/Repositories_of_datasets)

# Final Term Project: Option 1

## Submission (One File)

A word or pdf file (final term project report) containing:

- Source code of your classification algorithms.
- The websites where the software and complete dataset can be downloaded.
- All related documentation and documents including the manual you developed and **screenshots** showing the running situation and input/output of your programs. This report should be written in a tutorial style to explain through **screenshots** and examples how to run your tools on the dataset you choose.

# Final Term Project: Option 1

## Submission (cont.)

- In the final term project report, each student must present experimental results that show the comparison of classification accuracies between the two classification algorithms used in the project.
- In evaluating classification accuracy, each student should use the 10-fold cross validation method (if your algorithms predict labels) or present ROC and AUC (if your algorithms predict continuous probability values).

# Final Term Project: Option 2

## Unsupervised Data Mining (Clustering)

### Part 1

Generate a set  $S$  of 500 points (vectors) in 3-dimensional Euclidean space. Use the Euclidean distance to measure the distance between any two points. Write a program to find all the outliers in your set  $S$  and print out these outliers. If there is no outlier, your program should indicate so. Use any programming language of your choice (specify the programming language you use in the project).

Next, remove the outliers from  $S$ , and call the resulting set  $S'$ .

# Final Term Project: Option 2

## Part 2

(1) Write a program that implements the hierarchical agglomerative clustering algorithm taught in the class to cluster the points in  $S'$  into  $k$  clusters where  $k$  is a user-specified parameter value.

(2) Repeat part 1 and (1) above on two additional different datasets.

# Notes on the hierarchical agglomerative clustering algorithm

In determining the distance of two clusters, you should consider the following definitions respectively:

- the distance between the nearest two points in the two clusters,
- the distance between the farthest two points in the two clusters,
- the average distance between points in the two clusters,
- the distance between the centers of the two clusters.

Use the definition that yields the best performance where the performance is measured by the Silhouette coefficient.

# Final Term Project: Option 2

## Submission (One File)

A word or pdf file (final term project report) containing:

- Source code of your clustering algorithm.
- The website where the complete datasets can be downloaded.
- All related documentation and documents including the manual you developed and **screenshots** showing the running situation and input/output of your programs. This report should be written in a tutorial style to explain through **screenshots** and examples how to run your tool on the datasets you choose.

# Final Term Project: Option 3

This option is to implement a graph mining or graph clustering system. You can use any heuristics published in data mining articles and implement the heuristics using any programming language of your choice (specify the programming language you use in the project). Use any data set of your preference (specify the source of data, e.g. <http://snap.stanford.edu/data/index.html>). The output should be displayed using a visualization tool such as Graphviz or Cytoscape, etc. (specify the name of the visualization tool you use).



# Final Term Project: Option 3

## Submission (One File)

A word or pdf file (final term project report) containing:

- Source code of your graph clustering algorithm.
- The website where the complete dataset can be downloaded.
- All related documentation and documents including the manual you developed and **screenshots** showing the running situation and input/output of your programs. This report should be written in a tutorial style to explain through **screenshots** and examples how to run your tool on the dataset you choose.

# Final Term Project: Option 4

This option is to implement a text mining system.  
You can use Reuters-21578 dataset at

<http://archive.ics.uci.edu/ml/datasets/Reuters-21578+Text+Categorization+Collection>

To parse the documents, you can use  
Stanford CoreNLP tools at

<http://nlp.stanford.edu/software/corenlp.shtml>

Represent each document by a set of keywords.  
Find and print out association rules among the  
keywords or terms in the documents.

# Final Term Project: Option 4

## Submission (One File)

A word or pdf file (final term project report) containing:

- Source code of your text mining algorithm.
- The website where the complete dataset can be downloaded.
- All related documentation and documents including the manual you developed and **screenshots** showing the running situation and input/output of your programs. This report should be written in a tutorial style to explain through **screenshots** and examples how to run your tool on the dataset you choose.

# Final Term Project: Option 5

## Data Mining Using Hadoop/Spark in the Cloud

- This option is to implement a data mining algorithm (e.g. association mining, classification, clustering, etc.) of your choice on a dataset of your choice using Hadoop/MapReduce/Spark.
- Your final term project documentation must indicate clearly the algorithm, the dataset and the cloud environment you used in the project.

# Final Term Project: Option 5

## Infrastructure and Software

- Cloud infrastructure: Amazon EMR
- Programming software:  
Hadoop/MapReduce/Spark on an AWS  
cluster in a master slave fashion with multiple  
nodes using a programming language of your  
preference (e.g., Java)

# Final Term Project: Option 5

## Submission (One File)

A word or pdf file (term project report) containing:

- Source code of your data mining algorithm implementation using Hadoop/MapReduce in the cloud.
- The website where the complete dataset can be downloaded.
- All related documentation and documents including the manual you developed and **screenshots** showing the running situation and input/output of your programs. This report should be written in a tutorial style to explain through **screenshots** and examples how to run your programs on the dataset you choose.

# Final Term Project: Option 6

## Deep Learning

- When you choose this option, I will provide deep learning source code and datasets developed by our machine learning and data mining group and posted on GitHub. You will submit your project report directly to me, not to Canvas, before the due date.
- Email me at [wangj@njit.edu](mailto:wangj@njit.edu) to get details of this option.

# Project Grading

- There is a limit on the file size in Canvas. So, keep your project file small to avoid any problem that may occur when submitting the file in Canvas.
- The project file should contain the source code and documentation including **screenshots**. The screenshots are used to demonstrate the running situation of your programs, particularly how the programs execute and produce output based on different input data and user-specified parameter values.