CSE 352 Artificial Intelligence
Fall 2019
Professor Anita Wasilewska

http://www.cs.sunysb.edu/ ~ cse352

Meets Tuesday, Thursday 2:30pm - 3:50pm

Place JAVITS 111

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Office phone number: 632 8458
Office location: New Computer Science Department building, office 208

Office Hours

Tuesday, Thursday 4:30 pm - 6:00 pm and by appointment

Place New Comp. Science Building, Room 208, telephone: 2-8458

Teaching Assistants

There will be multiple TAs

TAs are responsible for **grading**

All grades are listed on **BLACKBOARD**

TAs ofice hours and other responsibilities will be listed on the course webpage

Course General Description

Artificial Intelligence is a broad and well established field and AI textbooks seem to be getting longer and longer and and often narrowly specialized. Our course attempts t to provide a concise and accessible **introduction** to the field. It is designed to give a broad, yet in-depth overview of different fields of AI. We will examine the most recognized techniques and algorithms in a rigorous detail. We will also explore trends, areas, and developments of the field in form of lectures based on newest research and applications.

Textbook There are two textbooks

Book 1

The Essence of ARTIFICIAL INTELLIGENCE, Alison Cawsey, Prentice Hall, 1998.

This is a short, not expensive, but not very technical book. We will cover in detail first 3 chapters and Chapter 5 supplemented by the Lecture Notes for technical details.

The chapter 7 is supplemented by the **Texbook 2** and extensive Lecture Notes.

Book 2

DATA MINING - Concepts and Techniques
Jiawei Han and Michelle Kamber
Morgan, Kauffman Publishers, 2011
Third Edition

Lecture Notes cover parts or all of CHAPTERS 6, 7 and CHAPTERS 8, 9 from 3rd edition

Do not need to buy the book. You can download detailed slides for Third Edition at

https : *//hanj.cs.illinois.edu/bk*3*/bk*3*_slidesindex.htm*

Class attendance is the most important, as the Lectures and **Lecture Notes** serve also as an **extra textbook** for the course and are integral and as important part of the course design

GRADING

During the semester you have to complete the following.

1. Quizzes - (30pts)

There will be **2 Quizzes** (25 minutes), 15 points each. Each quiz will consist of **1 - 3** questions.

NO make-up for quizzes.

2. Midtem - (65 pts)

3. Project (40pts);

4. Final(65pts)

5. Extra Credit You can earn up to **10 extra points** during the semester

Quizzes and Tests are **closed book** (and cell phones) examinations

None of the grades will be curved.

Homeworks I posted 4 Homework Assignments AND Homework Solutions. I encourage students to SOLVE homework problems first- and then to compare their solutions with those posted. Quizzes and TESTS will contain problems very similar to the Homework Problems.

Final grade computation

During the semester you can earn **200pts** plus **extra credit**. The grade will be determined in the following way: **# of earned points divided by 2 = % grade**.

The % grade is translated into a letter grade in a standard way i.e.

$100 - 95$ % is A, $94 - 90$ is $A-$,
$89 - 86$% is $B+$, $85 - 83$ % is B, $82 - 80$ % is $B-$,
$79 - 76$ % is $C+$, $75 - 73$ % is C, $72 - 70$ % is $C-$,
$69 - 60$ % is D range and F is below 60%.

Tentative Quizzes and Tests schedule

Q1 Thursday, October 10

Fall Break October 14 - 15

MIDTERM Thursday, November 7 in class

Project Data - Preparation - **5 extra points**

You submit it via **Blackboard** any day before **Thursday, November 14**

Thanksgiving Break ovember 27 - December 1

PROJECT - submit it via **Blackboard** any day before **Tuesday, November 21**

Q2 Tuesday, December 3

Last Class (Review for Final) Thursday, December 5

FINAL December 11- 19 - exact time and place to be scheduled by University

Course Content

The TEXTBOOK 1: **The Essence of ARTIFICIAL INTELLIGENCE** is very thin but we use it as it contains short overview of major areas of AI.

We supplement it with **Lecture Notes** and Extra Material for detailed information.

We also supplement it with the TEXTBOOK 2: **Data Mining - Concepts and Techniques** for Machine Learning and Association Analysis.

In particular we cover the following Texbook 1 and Texbook 2 chapters and subjects supplemented by extra materials, not always in the order they are listed below.

The course will to cover in depth **some** of the following subjects.

Chapter 1 AI history and applications. Lecture Notes

Chapter 2 Knowledge Representation and Inference.

Propositional and Predicate Calculus is presented in detail in Lecture Notes are EXTRA **Posted Materials**

Chapter 2- Logic Details for Chapter 2: Overview of Propositional and Predicate Logic; Predicate languages and basic Laws of Quantifiers; Predicate Logic Arguments. **Lecture Notes** and EXTRA Materials

Automated theorem proving DETAILS for Chapter 2: Propositional Resolution. **Lecture Notes** and EXTRA Materials

Automated theorem proving 2 DETAILS for Chapter 2: Predicate Resolution. **Lecture Notes** and EXTRA Materials.

Chapter 3 Expert Systems. Overview of EXPERT SYSTEMS Design and Technology.

Lecture Notes and EXTRA Materials.

Chapter 5 Natural Language Processing. **Lecture Notes** and Posted Presentations

Chapter 7 Machine Learning

The Textbook 1 is not technical- we use it as an intuitive introduction

We w use the Textbook 2: **Data Mining - Concepts and Techniques** for technical details

Lecture Notes cover parts or all of CHAPTERS 6, 7 and CHAPTERS 8, 9 from 3rd edition.

In particular we cover the following techniques.

Decision Trees - intuitive introduction and detailed algorithms

Neural Networks - intuitive introduction and detailed algorithm

Genetic Algorithms - intuitive introduction and detailed algorithm and applications

Association Analysis - Apriori Algorithm - details and applications

Classification by Association

Chapter 8 Agent and Robots - readings

New Advances

Deep Learning - extra Lectures Slides for Reading

Web Mining - an overview of methods and problems

Text Mining: an overview of methods and problems

Visualization techniques

Natural Language Processing - extra Lectures Slides for Reading

PROJECT DESCRIPTION

THE PROJECT GOAL is to use Internet based Classification Tools to build two type classifiers: **descriptive** and **non-descriptive**. Discuss the results. **Compare** these two approaches on the basis of obtained results.

1. Descriptive Classifier

Use a **Decision Tree** tool to generate sets of **discriminant rules** describing the content of the data.

Use WEKA:
http://www.cs.waikato.ac.nz/~ ml/weka/index.html)

2. Non-Decsriptive Classifier

Use **Neural Networks** tool to build your Classifier

Use WEKA or a tool of your choice. Describe specifics of your tool in a way that makes your report comprehensible for others.

Here are some tools suggestions:

http://www.mathworks.com/products/neural-network/?requestedDomain=www.mathworks.com

http://www.simbrain.net/

PROJECT DATA is provided on the course web page.

This is a real life classification data with TYPE DE ROCHE (Rock Type) as a CLASS attribute. There are 98 records with 48 attributes and 6 classes.

Classes are:

C1 : R. Carbonatees AND R. Carbonatees impures

C2 : Pyrate

C3 : Charcopyrite

C4 : Galene

C5 : Spahlerite

C6 : Sediments terrigenes

Most important attributes (as determined by the expert) are: **S, Zn, Pb, Cu, CaO+MgO, CaO, MgO, Fe2O3**

This is a real life experimental data and it contains a lot of missing data (no value).

The project has to follow the following steps of **Learning Process** to build the classifiers.

S1: Data Preparation that includes attributes selection, cleaning the data, filling the missing values, etc... to build Project DATA - **PD**.

S2: Data preprocessing

1. For the Decision Trees **Descriptive Classifier** you use 2 methods of data discretization to the Project Data **PD** creating two data sets: **PD1** and **PD2**. Describe which methods you used.

2. For the Neural Network **Non -descriptive Classifier** use the Project DATA - **PD** and your tool method of normalization of your choice. Specify which.

Building Classifiers

For each sets of data **PD1**, **PD2** (for Decision Trees), and **PD** (for Neural Networks) perform the following **Experiments 1- 3**.

For each Experiment **compare** the resulting **Descriptive Classifiers** with each other and compare each **Descriptive Classifier** with the resulting **Non-Descriptive Classifier**.

Experiments 1- 3

Experiment 1 : use all records to perform the **full classification** (learning), i.e. build a classifier for all classes **C1- C6** simultaneously.

Experiment 2 : use all records to perform the **contrast classification** (contrast learning), i.e. contrasting class **C1** with a class **notC1** that contains other classes.

Experiment 3 : repeat Experiments 1, 2 for all records with the **most important attributes** as defined by the expert only.

Write a detailed **Project Description** explaining all methods used, motivations, experiments results and their comparison, and submit it via Blackboard

ACADEMIC INTEGRITY STATEMENT (Adopted by the Undergraduate Council September 12, 2006)

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Any suspected instance of academic dishonesty will be reported to the Academic Judiciary. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at http://www.stonybrook.edu/uaa/academicjudiciary/

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Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and Disability Support Services. For procedures and information go to the following website: http://www.sunysb.edu/ehs/fire/disabilities.shtml