Introduction to Machine Learning

CS 307 --- Fall 2022

Course Project

Overview

- 12% of course grade
- spans the rest of the semester: you should start soon
- provides hands-on experience with employing machine learning techniques to tackle a prediction task
  - However, you may choose not to use machine learning
- everyone will work on the same task
  - you may work in a team of up to two people

Task: Binary Prediction Task

- Class value: 0/1
- 4 discrete-valued features
  - 3 binary-valued, 1 six-valued
- 172 real-valued features

- Training set: 12,000 instances
- Test set for preliminary evaluation: 5,000 instances
- Test set for final evaluation: 8,000 instances

- The test set will not contain targets, of course

What you need to do

- Predict the class values of the test instances
    - You may use any algorithms and techniques you want, including those that are not introduced in this course
        - You may even employ non-learning-based methods
    - You may use any publicly available software packages

Key Dates

- Preliminary evaluation: Dec 16
- Final evaluation: Dec 29
- Project report: Dec 30

Preliminary Evaluation (Due: Dec 16)

- 4% of the course grade
- The test set for the preliminary evaluation will be made available on the course website
- Need to submit (1) your prediction file, and (2) a README file listing the names of all group members to gradescope

Prediction File Format

- The file should be plain text
- Each line should contain **only** the predicted class value (0 or 1) of a test instance
- # lines in prediction file should be the same as # lines in test file
- You must return predictions to us in the same order as the instances in the test file
- Sample prediction file:

```
0
0
1
…
```

Scoring

- We will compute the accuracy (i.e., percentage of correctly classified test instances) of the system submitted by each team

- We will score the systems based on their accuracies
  - Your score will also be determined by how much better your accuracy is compared to the baseline accuracy
  - Details on scoring will be announced later

Final Evaluation (Due: Dec 29)

- 6% of the course grade
- **Goal**: a chance for you to improve your system after seeing how your team performs relative to the other teams
- The test set for the preliminary evaluation will be available on Dec 22 (one week before the deadline)
- Need to submit (1) your prediction file; (2) your code; and (3) a README file containing instructions on how to compile and run your system, as well as a listing the names of all group members to gradescope
    - Prediction file format and scoring are the same as those in the preliminary evaluation

Project Report (Due: Dec 30)

- 2% of the course grade
- The project report should describe everything that the team did for the project. It should
  - include approaches that were attempted but were ultimately not employed because of their poor performance, for instance
  - the approach that was chosen for final evaluation
  - lessons learned
- More details on the project report later …

Training Set

- Available from the course website shortly

Challenges

- Parameter tuning
  - Almost all learning algorithms have their own set of parameters
    - E.g., for neural nets, we need to specify the number of hidden layers and the number of hidden units per layer
    - The performance of a learner is to a large extent determined by these parameters
    - You probably want to tune them on validation data

What else can you try?

- Different learning algorithms
  - You can employ multiple learning algorithms to make predictions
  - Some learners may perform better than others
    - You may consider discarding the bad ones or putting less weights on them
    - How can I determine which learners are bad?
      - Use your validation data
    - How do I know how much weight I should give to a learner’s prediction?
      - Use your validation data

Anything else?

- Feature selection
  - Motivation: using all the available features may not always yield better results than using a subset of them
  - While many learners can (implicitly) select features, in many cases it may be good to explicitly identify and filter out the irrelevant features
  - How can we select good features?
    - Information gain
    - Let the decision tree learner tell you
    - Other methods (consult the literature)

Summary

- You can use whatever approach you want to do make predictions
  - Be creative!