

ECE4524 FA25 - Prof. Jones
Take-home Final Exam

Due December 10, 2025 – 11:59 PM via Canvas

In this final exam you will be developing a couple of different ways of applying AI solutions to the problem of diagnosing Coronary Artery Disease.

Part 1

Using Prolog (as in Assignment 3), develop a program to diagnose CAD. We want to determine one of the following conditions for any patient: CAD (coronary artery disease), No_CAD or Possible_CAD. The clinical rules you should implement are as follows.

- There are four important inputs:
 - Age
 - Chest Pain (Patient reports recurring chest pain)
 - a blood test for TG: ≤ 49 is low, ≤ 170 is high, above 170 is very high
 - a blood test for EF-TTE: ≤ 52 is low
- Chronic Chest Pain and High TG means CAD
- No chest pain but Age 60 and over and very high TG means CAD
- Under age 60 and low EF-TTE means possible CAD
- Under age 60 and TG is high means possible CAD

Implement your solution so that you can query it with probes containing values of Age (numeric), ChestPain (discrete atoms like chestpain and nochestpain), TG (numeric) and EF-TTE (numeric). Randomly choose twenty rows from the CAD.csv file (see Part 2) and measure the accuracy of your program. If your program predicts possible CAD, you can count it as a correct classification no matter what the actual diagnosis in the file.

Part 2

Write a Python program to load the data in the file CAD.csv, and develop a supervised ML model to predict the CAD diagnosis. The CAD target variable is in the last column; all other columns are suitable to use for predictors. Try two different model architectures (linear model, NN, SVM, decision tree, etc...). Note that this file ONLY HAS YES or NO for the target variable; there is no Maybe.

Be sure and obey best practices:

- Partition the data set into training and test partitions
- only report accuracy measured on the TEST partition
- make sure your model is not underfit
- make good choices for any model parameters (sizes, stopping criteria, etc.)

Part 3

Compare the two approaches. Write 1-2 pages on the differences and relative advantages and disadvantages. Things you may want to address are:

- Relative accuracy
- Ease in development and maintenance
- Ease in adapting to new data
- Clarity and explainability
- How does each approach embody “artificial intelligence”?

Your submission

You should paste all of the following into a SINGLE WORD FILE:

- The code from your Prolog program pasted in as plain unformatted text (no screen shots or dark-mode);
- The console output from testing your program on 20 randomly selected test cases - pasted in the same way (no screen shots or dark-mode);
- The code from your Python program pasted in as plain unformatted text (no screen shots or dark-mode);
- The console output from your program pasted in the same way (no screen shots or dark-mode), including accuracy measurement;
- The discussion that I have asked for above.

Also, attach to your submission your Prolog and Python files. Do NOT put your files in a zip file!

Grading Rubric:

1. Part 1 – 25 points.
 - 1.1. Implementation – 15 points
 - 1.2. Testing – 10 points
2. Part 2 – 35 points
 - 2.1. Data load and partition – 10 points
 - 2.2. First model architecture – 10 points
 - 2.3. Second model architecture – 10 points
 - 2.4. Model parameter choices for both – 5 points
3. Discussion – 35 points
 - 3.1. Discussion of accuracy – 10 points
 - 3.2. Discussion of development, maintenance and adapting to new data – 10 points
 - 3.3. Discussion of clarity and explainability – 5 points
 - 3.4. Discussion of the AI aspect (how embodied) – 10 points
4. Proper format and submission – 5 points