Math 260 Final Project 4/29/22

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**My Decision Tree:**

Unenticing

Unenticing

Enticing

Unhealthy

Hungry

Fasted

Ate

Full

Hungry

Full

Healthy

Unhealthy

Enticing

Healthy

**Summary:**

My final project consists of creating a decision tree by hand, coding up the data corresponding to that tree, writing the ID3 algorithm, printing the ID3 algorithm tree, and showing the efficacy of my algorithm. As you can see in Figure 1, my decision tree has four distinct attributes (meal, satiety, nutrition, and enticement) with two possible attribute values for each attribute and two possible classifications (water, dessert). There are many ways I could have made the data (i.e., dictionary, list of lists, etc.), however, I chose a more unorthodox route. I created a numpy array composed of unique combinations of variables representing the attribute values. I assign those variables 0s and 1s corresponding to the attribute values by following the tree. I then sampled from these 16 unique combinations using np.random.choice() to expand to a sufficient number of rows (i.e., 10000). Finally, I split the expanded data object to have a training set and testing set (two data objects). After creating the data, I wrote the main with four important lists corresponding to the attributes, changeable attributes, attribute values, and the classifications. Subsequently, I wrote the routine to run the algorithm. Next, I worked on the ID3 algorithm and Node Class. Finally, I worked out a way to classify the data to show the efficacy of my algorithm.

To test my ID3 algorithm, I went to [Kaggle](https://www.kaggle.com/datasets/miguelcorraljr/brilliant-diamonds?select=diamonds_dataset.csv) and selected a dataset related to diamonds full of categorical variables with a classification of natural or lab made diamonds. Although, there were important variables like price and carat, I removed them for this exercise to accommodate the decisions tree’s preference for categorical variables. My main challenge was to convert the data to my unorthodox setup of four lists (allattr, attr, attrvals, and classif\_list) and the data object filled with integers. I read in the file and converted the data to the desired structures. Subsequently, I used the already built algorithms to take care of the rest.

Results: Printed results from python console.

Thank you for your interest in the Food Choice Decision Tree

root

nutritional

unhealthy

satiety

hungry

meal

fasted

dessert

ate

water

full

enticement

unenticing

water

tasty

meal

fasted

water

ate

dessert

healthy

meal

fasted

satiety

hungry

dessert

full

water

ate

dessert

The decision tree is complete.

Now we look at the accuracy of the ID3 algorithm!

We have 100.0% accuracy!

What if we purposefully flip one classification in the test data

so that it does not follow the tree?

We get 99.9% accuracy, as expected!

**Diamond Real-World Data**

**But what about real-world data?!**

**This is the Diamond Classification Decision Tree!**

**root**

**report**

**GIA**

**natural**

**HRD**

**color**

**J**

**clarity**

**SI2**

**cut**

**Very Good**

**natural**

**Ideal**

**natural**

**Super Ideal**

**shape**

**Round**

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**Emerald**

**natural**

**Marquise**

**natural**

**Princess**

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**Pear**

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**Heart**

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**Oval**

**natural**

**Cushion**

**natural**

**Asscher**

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**The Diamond decision tree is complete.**

**How accurate is the ID3 algorithm with the Diamonds?!**

**We have 89.72231302438247% accuracy!**

**Thank you for your time! Have a great day!**