Application Using Decision Trees: Showing Students the Pathway to Success

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Abstract

The contract focuses on the development and creation of a Java program that seeks to reduce student stress and promote more efficient working habits. The first part of this contract investigates the decision tree structure, terminology and meaning behind this type of program. The operation of the decision tree as it is being traversed is discussed in detail. The contract will include some background information on the Myers-Briggs Personality Types and how it is able to provide meaningful information into providing more personalized help and guidance for students in academic and study-related issues. The contract then explores the creation of the program and the steps utilized to come to a working implementation that fits the criteria.

Creating an application that revolves around student success would involve multiple questions and prompts to the user to first gather the appropriate information needed for the program to be effective. The complexity and modularity of the topic pertaining to individualized student success creates a necessity for a program that would have be designed with efficiency and documentation in mind while utilizing all the data needed. It would also have to be able to give users different prompts based on their answer and choices to create a sense of uniqueness along with a more targeted result that would be applicable in their specific scenario and case. The requirements needed to meet such criteria would result in a program that is data heavy with the capability of going through lots of data in an efficient manner. Without a defined organization structure, prioritization of efficiency or trajectory of data traversal in mind the program would be difficult to improve on over time and would be more likely to cause errors along with slower execution and performance. The best option for such a program facing these criteria would be designing and creating the application on a decision tree structure.

Creating an application with decision trees involves traversing a pathway of a tree structured system to reach an outcome specifically based on the conditions met during the traversal period. Decisions trees is an ideology and type of data structure and management that helps solve specific applied problems. When it comes to collecting user data, utilizing a decision tree structure is a method that would be able to effectively prompt the user on only the questions it needs answered while excluding irrelevant information from being shown. Because of this, the user would be able to see a personalized subset of questions that are exactly what is needed without there being extraneous or repetitive information thus saving valuable time. The calculations needed for a decision tree to function is minimal and is less likely to cause an error compared to other methods. The adaptability and flexibility of user input and overall handling

also allows for the type of data being inputted to be edited. This means that the user could type in a string, or any other type of input data when necessary, freely allowing for input edits and changes. This becomes useful for larger data sets when there is a lot of information needing to be managed (*Data mining with decision trees: theory and applications*).
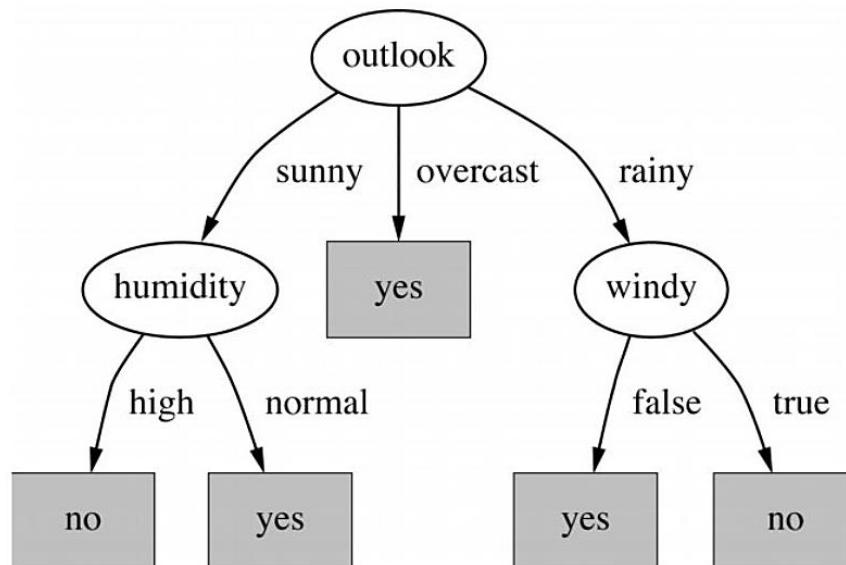

Figure 1: Example of a decision tree structure with various inputs that are dependent on the branch being traversed.

The initial creation of a decision tree begins with a specific prompt to the user or source of data to get the necessary information to start the traversal of a decision tree. The various options to answer the prompt that are provided would each represent a branch of the tree that could be further traversed. The branches and options provided would continue until the user would reach the end of the tree. Arriving to the end of a decision tree, in most scenarios, is due to the program having gotten the information that it needed and would then either end the program

with the information needed for the user or continue depending on the purpose and creation of the program itself (*Data mining with decision trees: theory and applications*).

Multiple students were surveyed to gather data on their most and least effective study habits during the process of trying to incorporate more applicable and better study advice into the program. What was soon realized was the stark differences in the study preferences of various students at CCAC. The results and data from the survey showed little to no correlation between specific study habits and higher rates of success. The lack of correlation could also be attributed to the many of the effective study habits contradicting each other. One of the contradictory results included how some of the students found themselves to be more productive in a study group while others found it better to be in a quiet environment by themselves. The research for individualized answers that promotes personal and more applicable study habits showed that

personality influencing personal preferences was a factor. This shows the need for unique results which will would be dependent on the type of person that is using the program. According to the Myers-Briggs Personality Type Indicator there are sixteen different personality types. This type of dataset allows for there to be accurate representation of the various personality types for any person with the results being specific enough to describe the person and his/her preferences.

Figure 2: The sixteen different Myers-Briggs personality types.

The Myers-Briggs Type Indicator (MBTI) is personality test that best fits the needs of determining a student's personality type and will subsequently be used as a part of the program. The creation of MBTI and all tests with the naming convention are based on the research of Carl

Jung, Katherine C. Briggs and Isabel Briggs Myers (*Essentials of Myers-Briggs Type Indicator Assessment).* The results of the MBTI are four distinguishable letters that make up a different dimension of the person's personality type. Each dimension has two different options, which is on a spectrum of the two contrasting types which depend on the person (*Essentials of Myers-Briggs Type Indicator Assessment).* The total four-lettered result is the extroverted/outwardly-expressed personality types within each dimension and can be used to know what type of study environments are most likely to work best for any given student. An example of this can be seen in the first dimension
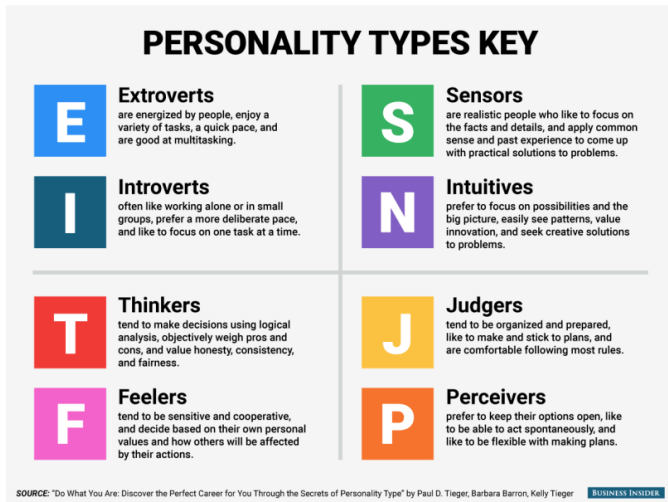

Figure 3: The four individual dimensions of personality type, each with two contrasting personality types.

differentiating between extrovert or introvert. If a student were to be more on the scale of being an extrovert than an introvert, then they get their energy from more social settings and are thus more likely to be more productive in social study groups. On the other hand, introverts get their energy from more personal and alone settings which makes them more likely to be productive when working by themselves in a more private environment.

The Program

Figure 4: Opening statement when run.

The program developed utilizes the information on decision trees and personality types to create a personalized and unique program that is made to incite individual student success. The

first part of the program uses its decision tree structure to troubleshoot and gather information on stresses that the student may be facing and its underlying cause through a series of questions. As the user travels down the tree, new inputs and prompts are used until the source of the stress is identified and the proper answer is provided based off the data and location of where the student ended while traveling down the tree.

Figure 5: A portion of the decision tree structure. Shown in NetBeans.

Once the student's trouble has been diagnosed and an appropriate solution is provided, the user is then brought to the personality portion of the success program. This part of the program takes in the user's MBTI personality type to understand and find the most accurate studying advice. This is accompanied with in-depth descriptions and optional background information for the student so that they understand the reasoning behind the decisions made by the program. This is made to be as informative as possible while also being efficient and dependent based on user input. If a student did not take the MBTI personality test or does not
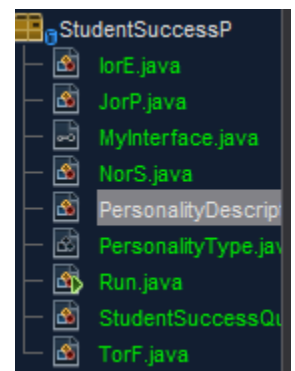
Figure 6: Classes that makeup the overall program.

remember their four letters the program allows users to enter "skip," to skip that portion of the program without creating any errors. If a user also types in a typo the program would let the user know that there was an error and let him/her try again without having to restart the program.

```
Please type your four MBTI personality type letters:
intd

Error: Please enter the exact 4 letters that are associated with your MBTI type:
intf

Error: Please enter the exact 4 letters that are associated with your MBTI type:
intj


Personality Type Entered: INTJ

Extraversion (E) vs Introvesion (I):
Would you like to receive background information on these two types? (yes or no) >
```

Figure 7: Showcases error detection. The first two entries are not valid personality types.

When the four letters are entered, the user gets an immediate response letting them know if they had entered a valid personality type. Once validated, the program then allows the user to get background information of each dimension of the personality type in a wholistic view before getting more detailed and relevant information on their specific personality type in relative to the dimension. The program continues by providing study tips and relative to their individual type with what is shown to be most effective. This provides valuable academic insights to help reinforce a certain preference due to the advice's potential of increasing productivity. More effective tips as a part of some dimensions are highlighted stating that the tip is effective to highlight its importance. This is done using the abstract implementation within the public interface called MyInterface in the program, which is then implemented in the respective personality dimension classes.

```java
public interface MyInterface {
    public String ItsEffective = "-Study Tips from this type are effective-";

    public void sayEffective();
}
```

Figure 8: Shows the interface that highlights dimensions with effective study tips when implemented.

Once the student has gone through all four dimensions, the program thanks the user for having tried the Student Success Program. It then notifies the user letting him/her know that the end of the program has been reached before promptly stopping. Once terminated, the console output remains on display and is available for reference until the application is either closed or run again.

At the conclusion of this student success-oriented program, therein showcases a working and effective program made to help diagnose student stress, offer personalized solutions, take in student personality types and then offer more personalized information to highlight the student's individual strengths with advice to increase productivity.

SHOWING STUDENTS THE PATHWAY TO SUCCESS

Below is an example of how the program compiles from start to finish on the user-end:

```
run:
Welcome to the Student Success Program!

All inputted answers should be either 'yes' or 'no' unless otherwise specified
Are you stressed and/or facing any difficulites in school?
> yes
Is it due to academic reasons?
> yes
Is it due to homework
> no
Is is due to exams?
> yes
What subject of the exam? enter one: math, english, other
> math
Advice: Try going to the Math Cafe, there are math tutors there who are able to help.
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This part is based off of MBTI personality types.
If you haven't taken the Myers-Briggs Personsality Type test, enter: 'skip'
Would you like to receive study tips tailored to your specific personality type? ('yes','no','skip')
> yes
Please type your four MBTI personality type letters:
intj


Personality Type Entered: INTJ

Extraversion (E) vs Introvesion (I):
Would you like to receive background information on these two types? (yes or no) > yes
The first of the four preferences is Introversion vs Extraversion. Extroverts get their energy from the outside environment in
They feel better and are more productive when in social settings and often look forward to going out. Introvertson the other h
from within themselves and are more productive when in by themselves. Social settings drain the enrgy of an introvert and does
enviornemnt for them. Extroverted people are accessible and seem to process things faster due to their ''act first think later
people on the other hand tend to have a more reserved attitude and can easily end up thinking deeply about a given before acti

You are an introvert
-Study Tips from this type are effective-
Study Tip: Having a preference of intraversion over extravarsion means that you work better
in a personal, more individual setting. You like to plan things out, which is a good trait
to have. Mind maps can help connect your thoughts. If you do end up studying with others,
 try to not pick a group of friends who are too outgoing or productivty would diminish

Intuition (N) vs Sensing (S) :
Would you like to receive background information on these two types? (yes or no) > no

You are Intuitive:
-Study Tips from this type are effective-
Study Tip: Being intuitive means that you like to know the why. Looking for patterns
and relationships often help and go a long way. Use your energy wisely and take breaks
ever to often to make the most out of your study time. Take part in evidence based note-taking
 and always see why the certain thing is important.


Thinking (T) vs Feeling (F):
Would you like to receive background information on these two types? (yes or no) > yes
The difference of thinking vs feeling involves the way decisions are made. Those who like to prefer
nthinking over feeling make their decisions primarily on logic. They try to not let feeling get
in the way of whatever they might be doing and are task and goal oriented. Those who prefer
feeling on the other hand make a lot of their decisions based off social considerations. They
listen and do what feels right and helpful to the purpose of society. They can be seen as more
people and value-oriented.

You are a Thinker:
Study Tip: Being intuitive means that you like to know the why. Looking for patterns
and relationships often help and go a long way. Use your energy wisely and take breaks
ever to often to make the most out of your study time. Take part in evidence based note-taking
 and always see why the certain thing is important.

Judging (J) vs Perceiving (P):
Would you like to receive background information on these two types? (yes or no) > no

You are a Judger:
Study Tip: Being intuitive means that you like to know the why. Looking for patterns
and relationships often help and go a long way. Use your energy wisely and take breaks
ever to often to make the most out of your study time. Take part in evidence based note-taking
 and always see why the certain thing is important.

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Thanks for using the Student Success Program!
You have reached the end of the program.
BUILD SUCCESSFUL (total time: 1 minute 4 seconds)
```

References

Quenk, N. L. (2009). *Essentials of Myers-Briggs Type Indicator Assessment*. Hoboken, NJ: John

Wiley & Sons.

Rokach, Lior; Maimon, O. (2008). *Data mining with decision trees: theory and applications*.

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Appendix

NRHC Proposal:

Showing Students the Path to Success

College students live hectic and stressful lives and face many decisions that ultimately impact their academic and personal well-being. I plan to research what stresses are most common among college students today and what methods are most effective in dealing with them. I will also gather data rooted in on-campus student interviews and surveys that I will design and administer, which will serve to reinforce my academic research findings. The research and data collected will go into creating a working program that will utilize the information to find the specific problem a student might face and help them determine the best action to take. The working program will be real-world tested to evaluate its effectiveness and to further strengthen its algorithmic structure. My poster presentation will demonstrate and show the effectiveness of my user interactive object-oriented program created in the Java programming language. The program would utilize traversing decision trees in order to create unique solutions individualized for the student. The results of the program and its effectiveness with real-world situations will be displayed in a statistical representation of data. The complete decision tree architecture that composes the program's core logical functions and pathways will also be shown as a part of the poster presentation.