AUTOMATIC GRADING SYSTEM

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PROBLEM

► The goal of the project is to integrate an Automatic Grading System to the BRBytes (https://www.brbytes.org/) program at LSU.

► BRBytes Computational Thinking assignments asks high school students to create images using Haskell programming language.

► Most automatic code grading is unit testing.
  ► Example: Is the output 3.14?
    ► If yes, then the output is correct.
    ► If no, then the output is incorrect.

► Unit testing does not work well for graphical outputs.
PROBLEM EXAMPLE

Code
```
main = drawringOf (clock_face)

  clock_face = numbers & blackOutline & ticksHour & ticksSecond1 & pin & arms & ticks

  blackOutline = colored(thickCircle(8.25,0.5),black)
  ticks = colored(translated(solidRectangle(0.2,1), 0.75),black)
  ticks1 = colored(translated(solidRectangle(0.08,0.25), 0.75), light (magenta))

  hr_number = 360/12
  minute_number = 360/60
  ticksHour = ticks
  & rotated(ticks.hr_number*1)
  & rotated(ticks.hr_number*2)
  & rotated(ticks.hr_number*3)
  & rotated(ticks.hr_number*4)
  & rotated(ticks.hr_number*5)
  & rotated(ticks.hr_number*6)
  & rotated(ticks.hr_number*7)
  & rotated(ticks.hr_number*8)
  & rotated(ticks.hr_number*9)
  & rotated(ticks.hr_number*10)
  & rotated(ticks.hr_number*11)

  ticksSecond = rotated(ticks1,minuteNumber*1)
  & rotated(ticks1,minuteNumber*2)
  & rotated(ticks1,minuteNumber*3)
  & rotated(ticks1,minuteNumber*4)
  & rotated(ticks1,minuteNumber*5)
  & rotated(ticks1,minuteNumber*6)
  & rotated(ticks1,minuteNumber*7)
  & rotated(ticks1,minuteNumber*8)
  & rotated(ticks1,minuteNumber*9)
  & rotated(ticks1,minuteNumber*10)

  ticksSecond1 = ticksSecond
  & rotated(ticksSecond, 60)
  & rotated(ticksSecond, 120)
  & rotated(ticksSecond, 180)
  & rotated(ticksSecond, 240)
  & rotated(ticksSecond, 300)

  pin = solidCircle(0.25)
  arms = rotated(translated(colored(solidRectangle(0.5,8), black), 0.3), 76)
  & rotated(translated(colored(solidRectangle(0.5,6.5), yellow), 0.2),282)
```
APPROACHES

- Compare different Machine Learning methods to find the one that works best for the automatic grading system.
- We can identify key factors from the high school students’ code:
  - Lines of code
  - Functions used
  - Quantity of variables
  - Name of variables
  - Whitespace
  - Comments
  - Output Image
MY PART IN THE PROJECT – PART 1

• Using SQL, I interacted with a database to retrieve URL links that leads to codes created by students.
MY PART IN THE PROJECT – PART 2

- A code was created in python to interact with the server to download the students’ codes using the links retrieved.
- There are three methods of organization that can be used to output the answers.
METHOD 1

- “newDataFiles”
- “question”_questionID
- “max”_maxPossible
- “question”_questionID_ScoreGiven
- counter_studentID_questionID
### METHOD 2

- “newDataFiles”
  - “question”_questionID
  - teacherUsername
  - sectionCode_maxScore
  - “Score”_givenScore
  - counter_studentID_questionID
METHOD 3

- “newDataFiles”
  - “question”_questionID
  - counter_studentID_questionID + clockdatafeatures.csv
```
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<thead>
<tr>
<th>Teacher ID</th>
<th>School Name</th>
<th>Section Code</th>
<th>Submission Time</th>
<th>File Name</th>
<th>Lines of Code Variables</th>
<th>Operators</th>
<th>Rotated Function</th>
<th>Complexity</th>
<th>Comments</th>
<th>clock right</th>
<th>Creativity</th>
<th>Actual Grades</th>
<th>Grade after grading</th>
<th>Comments from graders</th>
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MY PART IN THE PROJECT – PART 3

- After I finished with the third method, LSU graduate student Sirazum Tisha and I graded manually all of the 348 valid codes.
- Tisha used the new data to create and test a new machine learning algorithm that is able to automatically grade this clock question.
MACHINE LEARNING RESULTS

Using 70 samples for testing.

<table>
<thead>
<tr>
<th>Testing Methods</th>
<th>Correct</th>
<th>Incorrect</th>
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</thead>
<tbody>
<tr>
<td>Naive Bayes</td>
<td>85.71%</td>
<td>14.29%</td>
</tr>
<tr>
<td>SVM</td>
<td>95.71%</td>
<td>4.29%</td>
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<tr>
<td>Knn</td>
<td>95.71%</td>
<td>4.29%</td>
</tr>
<tr>
<td>Decision Tree</td>
<td>95.71%</td>
<td>4.29%</td>
</tr>
</tbody>
</table>
FUTURE WORK

- To create a script that produces randomized correct and incorrect answers samples.
- This will increase our samples count. Leading to a better trained algorithm.
- Tisha will continue working on this project. Aiming to successfully create an algorithm that grades the clock question.
- Then use the same steps to create more programs that grades other questions from the BRBytes program.
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REFERENCES

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