Intelligent Hinting and Affect Detection in SAGE

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1 Introduction

- **Primary motivation:**

  Improve effectiveness of hinting

- **Major focuses:**
  1. On-demand hinting
  2. Enrich hinting types
  3. Detect frustration

2 Related Work

2.1 “Advances in Intelligent Tutoring Systems: Problem-solving Modes and Model of Hints”

2.2 “Developing a Generalizable Detector of When Students Game the System”

2.3 “Early Prediction of Student Frustration”

2.4 “Coarse-Grained Detection of Student Frustration in an Introductory Programming Course”

2.1 “Advances in Intelligent Tutoring Systems: Problem-solving Modes and Model of Hints”

- adaptive support for learners
- hinting model
- three general hint categories
- greater adaptive abilities
- learning efficacy

2.2 “Developing a Generalizable Detector of When Students Game the System”

- Exploiting properties of the system
- Predicting when students are gaming the system
- Gaming phenomenon is fairly robust

2.3 “Early Prediction of Student Frustration”

- Developed frustration detector in Crystal Island
    1. Data about features
    2. Self-reported affective states
    3. ML techniques to build model
    4. Accuracy and precision over 88%

2.4 “Coarse-Grained Detection of Student Frustration in an Introductory Programming Course”

- Detect student frustration when learning programming on BlueJ
    1. Collect compilation and error data
    2. Recorded student affective states by human observation
    3. Built a linear regression model to predict frustration
    4. Able to predict average frustration in each lab session, but unable to detect frustration within each lab

3 Proposal

3.1 On-demand Hinting

3.2 Hinting Types

3.3 Frustration Detection

3.1 On-demand Hinting

- Only supports unprompted hinting
- Add the on-demand hinting function
    1. Add an on-demand hinting button
    2. Build punishment mechanism

3.2 Hinting Types

- Modify and expand current method
- Hints are divided into three categories:
    1. General text hints
    2. Category-level hint
    3. Specific hint
- More pleasant and gameful learning experience

3.3 Frustration Detection

Approaches to detect affective states:

- face-based emotion recognition
- physical or physiological sensors
- mining the system’s log file

3.3 Frustration Detection

Data-mining approach

- Collect features:
    1. Mean and standard deviation of the number of times the student has moved blocks
    2. Mean and standard deviation of the number of times the student has modified parameters of blocks
    3. Mean and standard deviation of time elapsed since the last action
    4. Number of actions taken in the last *x* seconds
    5. Number of times a block is removed from the scripts area

3.3 Frustration Detection

Data-mining approach

- Collect features
- Obtain affective states by self reporting
- Develop model using ML techniques
- Adjust hinting frequency

4 Timeline

Milestone	Estimated Date
Environment setup	Sprint 0
Add on-demand hinting function, and come up with basic model for detecting frustration	Sprint 1
Implement different hinting types, and enable prompting periodically affective states input from student	Sprint 2
Midterm report	Sprint 3
Try to get real world data from a group of students to develop and evaluate frustration detection model	Sprint 4
Final report	12.8 - 12.21

5 References

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