HCIR Project Proposal

Personalized Elective Finder

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1 Introduction

In today's competitive educational landscape, students often face the challenge of selecting elective courses that complement their hobbies, goals for their careers, and academic strengths. To address this, we propose the development of **MASGuido**, a socially interactive robot assistant designed to help students navigate through their elective options seamlessly. Leveraging the qiBullet simulation environment, Pepper will not only detect and recognize faces but also engage in meaningful conversations to recommend suitable elective courses based on individual preferences.

Objectives

The following are the project's main goals:

1. **Face Detection and Verification**: Utilize Pepper's camera to detect faces and optionally verify the identity of the user to provide a personalized experience.
2. **Multi-modal Greeting Behavior**: Upon detecting a face, initiate a customized greeting that combines speech and gestures, enhancing the user experience.
3. **Robust Interaction Handling**: Implement checks to handle noise and errors in face detection, ensuring smooth and accurate interactions.
4. **Conversational Assistant**: Engage users in a conversation to gather their preferences for elective courses.
5. **Preference-based Course Selection**: Develop an internal model using a Bayesian network to infer and rank elective courses based on user preferences.
6. **Illustrative Gestures**: Enhance conversations with appropriate gestures to make interactions more natural and engaging.
7. **Socially Appropriate Farewell**: Conclude interactions with a polite and socially appropriate farewell.
8. **Polite Language Filtering**: Implement a mechanism to filter out abusive language and respond politely.
9. **Optional Speech Input**: Allow users to interact with Pepper using speech input for a more natural conversation flow.
10. **Branding**: Name the agent and create a marketing slogan to give Pepper a distinct identity.

2 Bayesian Network Design

2.1 Introduction

A Bayesian network in this project would serve as a probabilistic graphical model to help Pepper infer which elective courses best match a student's preferences. Here's a detailed explanation of how a Bayesian network can be used in this context:

2.2 Define the Nodes

Each node in the Bayesian network represents a variable that could influence the decision about suitable elective courses. Possible nodes might include:

- **Student's Interests:** Categories like Artificial Intelligence, Data Science, Software Engineering, etc.
- **Difficulty Level:** Easy, Medium, Hard
- **Course Type:** Theoretical, Practical
- **Course Duration:** Short-term, Long-term
- **Prerequisites:** Required, Not required
- **Availability:** Morning, Afternoon, Evening
- **Elective Courses:** The list of elective courses available.

2.3 Establish the Dependencies

The dependencies between nodes in the network capture how student preferences influence course attributes and vice versa. These dependencies are represented by directed edges in the Bayesian Network.

The edges in the Bayesian network represent dependencies between the nodes. For instance:

- The **student's interests** influence the likelihood of selecting courses in related fields.
- The **difficulty level** might be influenced by the student's academic performance or preference for challenging courses.
- The **course type** could depend on whether the student prefers hands-on experience or theoretical knowledge.
- The **course duration** might be influenced by the student's schedule and availability.
- The presence of **prerequisites** could affect whether a student can take a particular course.
- **Availability** might be influenced by the student's free time or class schedule.

3 Define the Conditional Probability Tables (CPTs))

Each node will have a conditional probability table that quantifies the effects of its parent nodes. For example:

- For the **Student's Interests** node:
  - P(AI — Student's Interest = AI) = high probability
  - P(Data Science — Student's Interest = AI) = moderate probability
  - P(Software Engineering — Student's Interest = AI) = low probability

- For the **Elective Courses** node:
  - P(Course1 — Interest = AI, Difficulty = Medium, Type = Theoretical, Duration = Long-term, Prerequisites = Required, Availability = Morning)
  - And so on for other courses and combinations of attributes.

3.1 Infer the Best Courses

Given the preferences and attributes provided by the student during the conversation, the Bayesian network will calculate the posterior probabilities of each course being suitable. The courses with the highest probabilities are the most recommended.

3.1.1 Example Scenario

1. **Face Detection and Greeting:**
   - Pepper detects a face and greets the student.
   - Pepper shows if the face is not getting detected and allows a user to retry again.
   - If the face is recognized as a group member, a personalized greeting is given.
2. **Preference Gathering:** Pepper asks the student about their interests, preferred difficulty level, and other criteria.
3. **Bayesian Network Inference:**
   - Pepper inputs the student's preferences into the Bayesian network.
   - The network calculates which elective courses have the highest probabilities of matching the student's preferences.
4. **Course Recommendation:**
   - Pepper presents a ranked list of recommended courses to the student.
   - Pepper could say ,"Given your interest in AI"

, I recommend the following courses: 'Introduction to Machine Learning,' 'Advanced AI Techniques,' and 'Robotics and Perception.' These courses match your preference for a medium difficulty level and practical type of coursework."

4 Conclusion

The Bayesian Network for the Personalized Elective Finder is designed to comprehensively model the intricate relationships between student preferences and course attributes. By leveraging probabilistic inference, Pepper can provide tailored course recommendations that align with individual student goals and preferences, enhancing their academic journey. This network forms the core decision-making engine of our interactive assistant, ensuring that students receive the best possible guidance in selecting their electives.

5 Sketch of Architecture

The architecture is single-routed to convey electives that end-users might be interested. Once the robot identifies the face of the end-users, it initiates conversation to infer electives that the users might have an interest. Keywords that seem to be correlated with the course works are extracted from the text given by the users and the robot provides candidates based on the Bayesian network [1]. While it keeps the conversation, multi-modal reactions such as hand gestures or swirls are delivered as well. The preliminary structure is described in Figure 1.

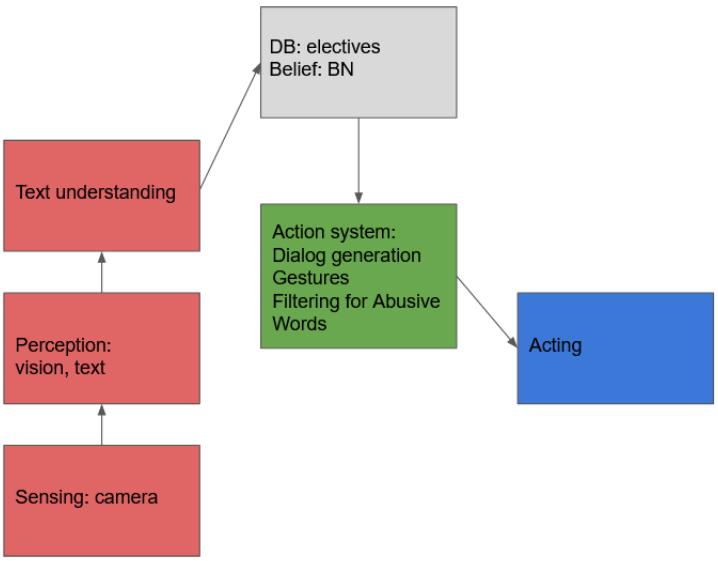

Figure 1: Preliminary version of the architecture

References

[1] Stephenson T A 2000