User Modelling

Essays

- Essay topics posted on web
- 4 topics, covering dialogue management, reinforcement learning, user modelling, and language generation
- Annotated bibliography due 24 Apr
- Papers due in Week 29 May

What we'll look for

- General overview of the topic
  - Why is it of interest? What's hard?
- Understanding of some of the basic issues in the field (e.g., portability, data collection, ease of use)
- Understanding of how these basic issues have been addressed in at least 2 implementations
- Understanding/critical analysis of evaluation metrics (if any) applied to case studies

Annotated bibliography

- Find at least 10 reference papers for your topic
- Briefly (one/two sentences; 2-3 bullet points) describe why paper might be relevant/what is interesting about paper
- Try to find a mixture of papers that describe basic facts about topic/implementations

What is a User Model

- A model of how the user interacts with the system and/or how the system responds to the user
- Can model the task (and how to aid the user to accomplish it)
- Can model the user (characteristics relevant to application)
- Can model the interaction (input/output devices, how the user interacts with these)
- Can model the presentation (modality)

Why do user modelling

- No single interface will satisfy all users
- Users have different needs and those needs change over time
- Adaptive systems monitor users interactions and change the interface/content
- Contrasted with "training wheels" systems that simply disable/simplify system components

What is user modelling in SDS context?

- Adaptive systems
- Error handling
- Types of user modelling:
  - Dynamically adaptable--based on current interaction
  - Adaptable over time--based on data gathered over time for particular user/user population

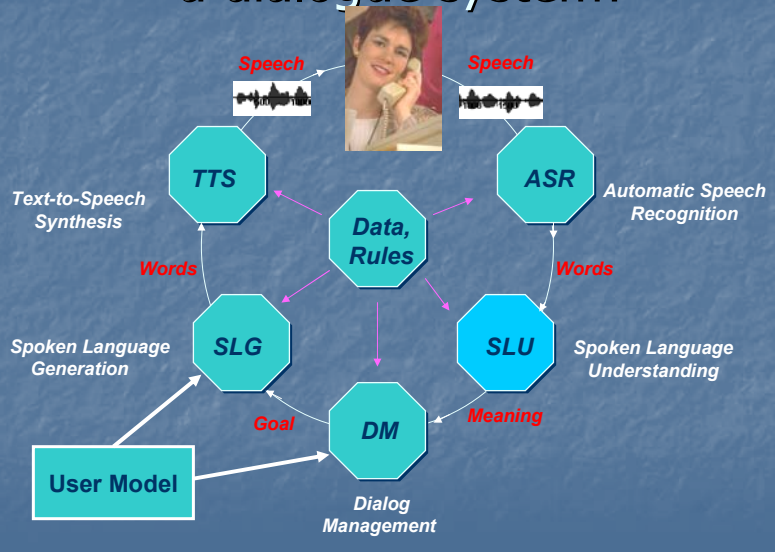
Functions of user model (Jackson, 2003)

- Supporting system use
  - Performing routine tasks automatically
  - Adapting the interface
  - Providing advice
  - Taking control of the dialogue
- Supporting information gathering
  - Helping users get information
  - Tailoring presentation to specific users
  - Recommending
  - Supporting collaboration
  - Providing ability to learn

Question

- What classes of attributes do you think should be in a user model for a spoken dialogue system that provides information about restaurant/theater options? Or one that enables checking on/trading within one's stock portfolio? How could the contents of the user model be used to guide the system in speaking (or displaying) information to the user?

How does the user model fit into a dialogue system?



Attributes maintained in user model

- User preferences, interests, attitudes and goals
- Proficiencies (e.g. task domain knowledge, proficiency with system)
- Interaction history (e.g., interface features used, tasks performed/in progress, goals attempted/achieved, number of requests for help)

Inputs to user model

- Explicit preferences, goals from questionnaires
- Explicit personal characteristics (e.g., job, account information)
- Self assessments
- Specific actions
- Vision and gaze tracking

Techniques for automatically constructing user models

- Bayesian (probabilistic)
- Logic-based (e.g.inference techniques or algorithms)
- Machine learning techniques

Some simple examples of user modelling

- Storing, retrieving, and using specific details about user in querying database
  - Preferred airline
  - Home airport
- Modifying language model to reflect details of user's account
  - Boost probabilities for particular stock names in financial application

Why do user modelling in spoken dialogue systems?

- Domains are complex
  - Large amount of information
  - Multiple sources of information
  - Complex interplay of constraints
- Delivery modality can be quite simple
  - Small screens
  - Telephone-only

User modelling in spoken dialogue systems

- Spoken dialogue systems typically provide interfaces to large amounts of data
- Two choices are available:
  - Expect the user to construct a model of domain
  - Let the system build a model of user
- Spoken dialogue systems are meant to be partners in a mixed-initiative system, meaning that both sides contribute to achieving final goal
- Some sort of data compression is necessary
  - Compression should be done in a personalized way
  - Customization should streamline process of information delivery

Example of SDS with user model: Kyoto city bus information system (Komatani, '03)

- System determines which bus a user wants to take
- System tells user how long it will take for bus to arrive
- 652 bus stops in Kyoto/85 bus routes
- Bus information changes continually
- Important to communicate information quickly

Example dialogue

- System: Please tell me your current bus stop, your destination, or the specific route.
- User: Shijo-Kawaramachi.
- System: Do you want to take a bus from Shijo-Kawaramachi?
- User: Yes.
- System: Where will you get off the bus?
- User: Arashiyama.
- System: Do you want to go from Shijo-Kawaramachi to Arashiyama?
- User: Yes.
- System: Bus number 11 bound for Arashiyama has departed Sanjo-Keihammae, two bus stops away.

Dimensions modelled

- Skill level
  - Lower skill level: more guidance (e.g., more yes/no questions, more instruction)
- Domain knowledge level
  - Kyoto natives might want more detailed information (e.g., alternate route)
- Degree of "hastiness"
  - If user is in a hurry, streamline interaction (i.e., no confirmations)
  - If user is not in a hurry, modify system along previous two dimensions to reflect user model

Features used by user model

- Presence of barge-in
- Elapsed time of current utterance/from beginning of dialogue
- Recognizer confidence score
- Number of slots filled by current utt
- How bus stop specified (i.e., correct name used)

Implementation of user model

- Decision tree based
- Trained on 215 dialogues, 1492 utterances
- Each utterances labelled by hand for each dimension in user model
- Features collected over utterances/completed session
- Deployed system (changing dynamically) deployed on 20 naïve subjects
- With user model, both duration and number of turns decreased significantly with user model
- Novice users showed equivalent decrease in amount of time using system
- More users judged overall as experienced when using user model