

1. Interactive Stories
2. Networked Spaces
3. Agents for E-Markets
4. Data Visualisation
5. Other topics suggested by students (provided there is agreement)

A *concrete topic* will have to be refined by each student who will work with me on one of these themes. This will be done under my supervision.

1. Interactive Stories

Objective: the investigation of computational models and techniques, and development of software systems that are able to tell a story in different ways at different times, depending on the preferences and context of the listeners. The focus will be placed on entertainment stories for children (such as Harry Potter), but other forms of “stories” may unreservedly be investigated (such a tutoring systems).

A story, if told and retold by a human narrator, normally is reshaped to suit the audience, the new experiences and mood of the narrator, etc. Printed books lack this quality. The idea behind this theme is to develop software systems that replicate the (adaptive ability of) human narrators.

Example: Consider a story that has many characters and whose actions happen in different locations, sometimes more than one happening at the same time. A child could choose to “become” one of the characters and experience the story from its point of view. Another possibility would be for the child to move freely between locations and have the story adapted to his/her movements. Further, the story may “ask” for input from the child at different moments of time and, on this basis, may “decide” upon a specific ending.

Possible directions of investigation (not necessarily disjoint):

- variables along which the story can be structured, including:
 - space (e.g., woods, castle, home, ...)
 - character (e.g., prince, princess, dragon, fly, horse, ...)
 - time (e.g., tell the story in the chronological order of the events; tell the story in a reverse order of the chronological order, ...)
 - storyteller – who tells the story (e.g., the narrator, the prince, ...)
 - outcomes or points of view (e.g., princess marry prince, good wins, ...)
- means of interaction, including:
 - computer/desktop choices
 - tagged objects of the real environment (e.g., toys, objects in the household, objects in the playing field, the children themselves, ...)
- forms of interaction, including:
 - story “tells” child what to do
 - child makes choices (see above, “variables along ...”)
 - community interaction
 - interactions between two children (e.g., one determines what the other one hears)
 - interactions between a group of children (e.g., all listen to the same story whose flow is determined by some average of all the children’s interactions, forms of collaboration and negotiations – this move it towards games, children become characters in story...)
 - rewards (e.g., given by parents, given by the story’s software, given by other children, ...)
- levels of adaptability/flexibility of story, including:
 - all the scenarios/paths are clearly pre-defined (at authoring time);

- paths emerge through interaction: at authoring time all the material is placed in a database and all the rules of interaction are set; then, the story is left to develop freely on the basis of the children's interactions
- allow for new material to be added (e.g., by parents, by children, ...)
- allow for stories to be continued by children
 - e.g., in psychology, children are told a story with toys, that mirror some events that happen in real life, and then children are asked to continue the story (this revealing the meaning they give to the real life event(s))
- purpose of story, including:
 - entertainment
 - education
 - determine child to carry out some actions in the real world
 - investigate child's responses

Advanced topics include:

- representation issues in interactive non-linear story telling
 - e.g., rules, planning, agents, ...
- authoring of interactive non-linear stories.

Mode of work: Work will start with the development of solutions and prototypes for a concrete story. Generalisations will subsequently be attempted. Implementation is necessary, though no constraints are imposed on the technology to be used.

Further details: This work is parallel to my research in the NM2 – New Media for a New Millennium – project (refer to my homepage for details).

Previous students who worked on this theme: Jenene Sterling (CS 2005-2006)

2. Networked spaces

Objective: Via new means of interactions, such as RFID, mobile phones with GPS, etc, the real and the virtual space can be brought into a single one – a networked space. This theme refers to the development of applications that require the connection of the real space with virtual spaces, from both directions: interactions in the real space may be used as means of navigation in a virtual space (e.g., the trajectory of a visitor in a museum (e.g., the sequence of the visited exhibits) can determine the explanations heard in a headphone generated by the museum's software) and, conversely, interactions in the virtual space may determine actions in the real space (e.g., advice from a software may determine which path through a city a visitor takes).

Example applications include:

- tourist adviser in a city (e.g. advises on which objectives to visit depending on the previous track and user choices/preferences)
- visitor adviser in a museum (e.g., same as above, but the advice is related to museum exhibits)
- architectural adviser (e.g., provides information about important buildings that is not accessible from outside the building, such as structural plans, the concept that was at the basis of the building, how the area looked before the building was built, ...)
- military adviser (e.g., details plans (routes, targets, times) specific to the current area)
- mobile phone advertisement (e.g., use tagged landmarks as triggers of adverts that are deployed on the mobile phone)
- games that combine the real and the virtual space (e.g., treasure hunt – could be single or multi-player; if multi-player then different collaboration and competition strategies could be investigated –, games in the virtual space that require actions to be done and recorded in the real space (e.g., via pedometers and location aware devices), ...)

- distribution centre for community interaction via mobile phones (e.g., finding useful information in London (such as where to take a cab from, where to do late shopping) by asking people who may know this and are registered with the software as experts, ...)

Mode of work: The application will have to be designed as a whole. Parts of it will have to be simulated, at least, with prototype software. No constraints are imposed on the technology to be used.

Previous students who worked on this theme: Thomas Bundy (CDWWW 2004-2005), Robert Peacock (CDWWW 2004-2005), Sumeet Adur (CS 2005-2006), Mita Datta (CIS 2005-2006), Irfan Khan (CIS 2005-2006), Sophia Theophilou (CIS 2005-2006).

3. Agents for e-markets

Objective: An e-market for agents is a place where commercial transactions are made by software agents on behalf of the humans who control them. Software agents encapsulate objectives such as “sell as high as possible, but make sure you sell”, “sell as many as possible”, “buy as low as possible but make sure you buy”, ..., and are able to interact autonomously with other software agents. The objective of this theme is to investigate market strategies that can be implemented in software agents and corresponding emergent market behaviours (resulting from the interaction of such agents).

Examples: have software agents who buy and sell at an auction; distribute tasks/jobs to employees of a company (e.g., engineers at BT), the engineers being represented by software agents, ...

Possible directions of investigation (not necessarily disjoint):

- modes of interaction
 - each agent is independent/autonomous until it achieves its purpose
 - this presupposes that each agent has its own well defined goals
 - agents congregate in groups in order to achieve common goals (which, at least partly, serve the individual goal of each of them); investigate
 - collaboration strategies
 - competition strategies (e.g., negotiation)
 - agents only gather and summarise data, but ask the human “owner” to take the important decisions;
- local (at agent level) strategies
 - devise configurable strategies
 - devise ways to implement (or represent) them within agents
- communication methods between agents
 - what information makes each agent available about itself (e.g., if no information is made available, the agent may be left out from the communication process by the other agents; alternatively, if too much information is made available, then the agent may never achieve its goals due to competition)
 - trust – how much of what an agent makes available is to be trusted?
- global strategies
 - experiment how global goals can be achieved, bottom up, from the agents’ individual goals
- types of markets
 - homogeneous agents – all agents are of the same type; users choose the number of agents to represent them and configure each according to their purposes
 - heterogeneous agents – the market allows agents of different capabilities (they will have to have some common vocabulary)
- problem modelling
 - express a specific problem in terms of agents (alternatively, devise a solution in terms of agents to a specific problem)

Mode of work: from specific problem towards general conclusions; incremental, prototype-based development. A specific problem will be chosen and an agent-based solution will be devised for it. A corresponding prototype software will be implemented. After experimentations, amendments are brought to the design and subsequently are implemented in the prototype; and so on. General conclusions may be drawn. The recommended technology is Java's support for agents. However, agent behaviour may be simulated in other technologies (including scripting languages!).

Further details: This work is grounded in my research for BT for resource allocation (refer to my homepage for details).

Previous students who worked on this theme: Thomas McDonald (CS 2004-2005)

4. Data Visualisation

Objective: Data Visualisation is the process whereby chunks of alphanumeric characters (or, simply, chunks of numbers), organised in certain structures, are transformed into (equivalent) images (pixels). Normally, the initial chunk of numbers is very difficult to be interpreted. Normally, the corresponding image is easier to interpret. For example, it would be very difficult to understand the heat distribution on a surface if it were represented as an array of positions on the surface and corresponding temperatures. However, if ranges of temperature are represented by colours (furthermore, adjacent temperatures having adjacent colours in the spectrum) then the data is much easier to interpret. Within this theme students will explore data visualisation techniques and will discuss their strengths and weaknesses. Alternatively, they will transform numbers into beautiful pictures for fun.

Possible directions of investigations (not necessarily disjoint):

- visualise large collections of data / databases (aggregation via visualisation)
- find correlations by visualisation (data mining by visualisation)
- habits, tagging and visualisation – automatically record data about daily routines, via tagging and other similar technologies, gather data over a period of time and visualise “results/trends”
- make art from algorithms
 - procedural algorithms
 - draw via agent interaction
 - shape grammars

Method of work: different algorithms will be implemented and experimented with. Implementation is essential and a programming language with provisions for graphics is necessary (e.g., Java or C or C++).

Further details: This is a new theme that I started this year.

5. Other topics suggested by students

I am happy to consider students' proposals that do not fall within the above mentioned themes. In the past I supervised projects involving databases, knowledge bases, scripting programming, Java programming, Prolog programming and the implementation of artificial intelligence techniques.