Thesis Topics - April 2015

Affective Storytelling

1. **The Embodied Conversational Agent (ECA) Companion in an Interactive Reading Environment (This is a funded research project with CEHCI and Psychology Department.)**

* An affective peer who can engage the reader in a conversation during a story reading session
* Existing research that the proposed topic will work on:
  + The ECA elicits emotional changes from the reader/student as needed to motivate learning by disrupting a student’s negative affect (emotional) state and shifting it to a more positive one
  + Text-based “dialogue” in the form of system questions and user responses (based on a given set of possible choices)
  + Problem: the ECA engages the student in a conversation only when the student is taking the reading comprehension quiz; however, preliminary end-user testing showed that the students do not even reach the quiz because he/she is not motivated in reading the prescribed story/material

Research Problems:

* To motivate the child to continue reading the story while helping address his/her cognitive and/or affect dilemma (*Why is he/she not engaged in reading? Is there a reading comprehension problem, a plot problem, an affinity with the story character problem, and other problem?*)
* How can embedding a tutoring interaction inside a story, game or activity with a virtual agent affect learning gains and engagement with virtual agents?
* Consider the use of free-form dialogue, but requires the use of text understanding techniques
* The dialogue can center around the story itself, but needs to model the story using commonsense knowledge (concepts, events, relationships)
* To employ an animated ECA who expresses emotion not only through text, but also through facial expression, head movements, and gestures
  + How will interactions with animated on-screen virtual agents affect learning gains and engagement? (vs Physical robots >> Spaulding & Breazeal 2014, Exploring Child-Robot Tutoring Interactions with Bayesian Knowledge Tracing)
* Commonsense in Affective Classification of Text -- prelude to understanding impact of stories to reader's emotions
  + - * Liu, Lieberman and Selker, 2003. A Model of Textual Affect Sensing Using Real-World Knowledge

▪ affective qualities of things, actions, events, and situations

▪ inferring the affect of written text

* Given a word, the affective text classifier can follow links to consequences and post-events that had a clear affective association and assign an emotional valence

1. **Reader's Affect Model (This is a funded research in collaboration with CEHCI and BNSCWC.)**

The task of reading a selection elicits certain emotions from the readers. This emotion can have a profound effect on the reader’s comprehension and enjoyment of the selection. When integrated into a learning environment, the emotional states of the learners affect their motivation or de-motivation to use the system longer, thus increasing or decreasing their learning opportunities.

For computers to establish healthy relationships with their human users, they must be attuned to the emotional states of their users to provide affective responses appropriately. In this research, we want to investigate the affective response of the readers when reading a story through the use of emotion recognition devices. Affective responses include cognitive and emotional dimensions, and include the academic emotions engagement, confusion, frustration and distraction. This can find applications in intelligent tutoring systems that utilize an embodied conversational agent to understand difficulties of the reader and plan intervention activities to motivate and increase chances of learning.

Azcarraga and Suarez (2012) at the Center for Empathic Human Computer Interaction posits that “the expression of (academic) emotions may be manifested not only through facial expressions but also through other physiological reactions”. Their work investigates the various brainwave patterns and how these are associated with positive and negative emotions (confusion, interest, frustration, and boredom) of the academically-gifted learners.

The proposed research seeks to develop an affect model of readers in secondary schools (age 13-17) as they read a story text, and identify factors that trigger these emotions. The affect model will show the relationships among physiological signals, reader’s profile and academic emotion, and factors causing these emotions.

Specifically, the research aims to address the following questions:

* What elements of stories affect the readers?
* What types of academic emotions are elicited by the stories from their readers?
* What patterns of brainwave signals correspond to the different types of academic emotions that readers experience in the course of reading a story text?
* What applications can potentially find use for these emotional responses?

General Objective of the Research:

To analyze the physiological signals collected from readers as they are reading stories in order to associate patterns of physiological signals to specific academic emotions.

Story Generation

1. **Story Retelling System**

Stories have been retold again and again to impart important culture and values among young readers. The use of NLP summarization techniques has given rise to systems that can automatically provide a summary of news articles. Can we expand this idea to extract major events in a story and retell them in a simpler format suitable for younger audience? Examples of stories that have been simplified and summarized for younger audiences are fairy tales, adventures of Pooh, Thomas the Tank Engine, and even classic novels.

Research questions:

* What summarization techniques can we apply?
* What other NLP strategies can we employ, e.g., text / story understanding, story understanding?
* What aspects of stories do we focus on - causal events? character development?
* Do we employ text simplification strategies to modify the structure of the resulting story text?
* Will the NLP techniques and strategies require any knowledge source to perform their tasks?

1. **Storytelling based on Data**

Can we use these approaches to improve the story generation process of PB4?

* Learning to tell Tales - McIntyre, 2011
* Discovering and Characterizing Emerging Events in Big Data (DISCERN) - Dorr, 2014
* Indexing Stories for Conversational Health Interventions - Manuvinakurike, 2014
* ACL 1st Workshop on Data to Text Generation, 2015
* http://www.sicsa.ac.uk/research/research-themes/human-computer-interaction/

Every day, huge numbers of people interact with information, and each other, via a diverse set of systems that combine computing and communication. Yet, while the amount of information online inexorably increases, our systems remain less usable and useful than they should be, with problems at the interface between human and system.

Today, the commonest case of information access involves an individual person sitting at a computer screen, typing a query in English a search engine. This time-worn model of interaction is out of date; but going beyond it demands a new approach to human-information interaction which combines an understanding of people, and information, and the interactions between them: individual human intellectual and social abilities; means of structuring vast amounts of information; and ways of exploiting multiple rich communication channels.

Virtual Agent / Human - Robot Interaction

Humans and human environments bring with them inherent uncertainty in dynamics, structure, and interaction. HRI aims to develop robots that are intelligent, autonomous, and capable of interacting with, modeling, and learning from humans. (AAAI Fall Symposium 2014)

Integrated cognition is concerned with consolidating the functionality and phenomena implicated in natural minds/brains and/or artificial cognitive systems (virtual humans, intelligent agents or intelligent robots). The aim of this symposium is to bring together researchers from across the spectrum of approaches and perspectives to exchange research results and discuss how best to create an ongoing forum for such exchanges. The focus is on how the mind arises from the interaction of its constituent parts, and includes everything implicated in human-level performance in complex environments. This includes not only traditional cognitive aspects — such as planning and problem solving, knowledge representation and reasoning, language and interaction, reflection and learning — but also perception and control, personality and emotion, and motivation. (AAAI Fall Symposium 2013)

1. **Socially Intelligent Virtual Agents**

* For robots/computer systems to be able to intelligently interact wth their human users in accomplishing everyday tasks, they must be aware of social practices / social dynamics inherent in human environments and interactions.
* "The unwritten rules of human cultures greatly affect social behaviour and as such should be considered in the development of socially intelligent agents." (Mascarenhas, Prada, Paiva & Hofstede 2013, Social Importance Dynamics: A Model for Culturally-Adaptive Agents, LNAI 8108; Mascarenhas, Marques, Campos & Paiva 2013, Model of Social Dynamics for Social Intelligent Agents, AAAI 2013 Fall Symposium on Integrated Cognition, Virginia)

Research Problems:

* Generating stories that incorporate social practices and norms in the interactions and dialogue among story characters ==> Michael Bonon
  + Modelling concepts on social norms that the planner can use
  + Planning events around social norms, the "why" and "with whom", so that "basic features of our social behavior that we see early in the lives of children should be made prominent" (Hofstede 2014) for stories to serve their purpose of educating its readers.
  + Character actions are influenced by their inner drives (avoidance and fear, approach and love, aggression when thwarted) and motives, which in turn are "deeply social". (Hofstede 2014, Raising Agents: Sources of Human Social Intelligence, European Conference on Social Intelligence, Barcelona)
  + Children are socialized to acquire norms and values. (Hofstede 2014)
* Building a dialogue model for interaction between a socially-intelligent virtual agent and a human user for tutoring apps or interactive storytelling apps
  + Modelling social norms that the dialogue planner can use
  + Generating dialogues that consider social norms
  + Can be integrated with the ECA Dialogue (#2) or the Collaborative Story Writer being developed by a BSCS thesis group
* Enhancing Ellie to be socially assistive to provide personalized support for children with autism
  + Greczek 2014, Socially Assistive Robotics for Personalized Education for Children

Ideas from NAACL 2015

**Workshop on Computational Linguistics and Literature**

* The reader's needs and their mapping onto NLP tasks >> ECA Reading Companion (#1) and Reader Affect Model (#2)
* Search for literary work, and useful recommendation systems for literature
* Computational modeling of narratives
* Summarization of literature >> Story Retelling System (#5)
* Emotional analysis for literature >> Reader Affect Model (#2)

Health Informatics / Personalized Health Care

AAAI Fall Symposium 2014

The rise of novel methods and tools for collecting and storing large amounts of personalized health data (for example from various types of electronic health records and from new sensors) has made vast amounts of data available. Several projects have shown that sharing this data offers multiple advantages to both physicians and patients, enabling them to globally identify similar patient cases and discover successful therapies from other patients and physicians. Access to this information, from a multitude of data channels, allows for shared decision making that enables physicians to personalize care decisions and, at the same time, supports patients' engagement in their own care. This paradigm shift, termed participatory medicine, will eventually lead to improved patient outcomes and reduced healthcare costs but significant challenges must be addressed before its full promise is realized.

In addition to providing physicians with the necessary tools to effectively take advantage of available medical data, patients will need guidance so they can embrace their new roles as active participants in their care. The physician-patient relationship will transition from one- to two-way communication where patient treatment becomes a feedback rather then feed-forward process. Similarly, information technology will need to evolve to improve communication, collaboration, and teamwork between patients, their families, and care teams involving practitioners from different fields and specialties. All of these changes require novel solutions and the AI community is well positioned to provide both theoretical- and application-based methods and frameworks.

The goal of this symposium is to focus on creating and refining AI-based approaches that (1) help patients (and families) participate in the care process, (2) improve patient participation and (3) help physicians utilize this participation in order to provide high quality and efficient personalized care. The extraction, representation, and sharing of health data, patient preference solicitation, personalization of generic therapy plans, adaptation to care environments and available health expertise, care team coordination, and making medical information accessible to patients are some of the relevant problems in need of AI-based solutions.

**Topics**

This symposium focuses on AI-based methodological and application contributions in health informatics and its aim is to foster opportunities for collaborative research within a multidiscipline research community that offers expertise in medicine, bioinformatics, computer and information science. Topics of interest include but are not limited to the following:

* Methods for knowledge extraction (leveraging social, population, clinical data) and personalization via intelligent predictive analytics
* Design of integrated health information systems to accelerate the discovery of health knowledge, and the design of personalized care systems (including telehealth and ambient assisted living) to disseminate the discovered knowledge and enable patients to provide feedback to physicians about their ongoing care
* Innovative use of social media for patients' education, empowerment and engagement
* Supporting personalized care delivery by interdisciplinary health care teams by modeling patient-focused workflows and supporting their adaptation (setting, experience) and execution
* Decision support systems for eliciting patient preferences and for shared decision making by health care providers and patients