

INITIAL PLAN

IMPLEMENTATION OF AN ONTOLOGY-DRIVEN CONVERSATIONAL AGENT

Author: Jay Rainey

Supervisor: Irena Spasic

Moderator: Yukun Lai

Module number: CM3203

Module title: One semester individual project

Credits: 40

Description

Health behaviors that negatively affect an individual, such as lack of physical activity or an unhealthy diet are responsible for the most deaths in the United Kingdom per year [1]. The application being developed aims to address this by counseling users regarding their negative health choices and habits in a none-intrusive way, i.e. through by brief motivational interventions (BMI).

BMI's will be used as the counseling technique as they are suitable for all stages of change [2] (i.e. if a user is actively improving their lifestyle or one who is unaware of the impact of their current lifestyle), and is best suited to a free-form style of application, i.e. facilitating behavioral change through independent conversations, open-ended questions, and user reflection.

To achieve this, I aim to develop a health-based ontology, which will be used to determine the context of users message. Once determined, a suitable counseling response will be selected (from a pre-defined set), and used to continue the conversation with the user. Ultimately, the goal is to invoke reflection regarding users lifestyle choices in an attempt to elicit behavioral change.

This project differs from other ontological driven health applications [3] as it focuses on *free-form* user messages, and the analysis of these, rather than providing users with options to select response from. Moreover, BMI techniques have not been previously used in automated conversational systems.

Aims and objectives

Conceptually, the main aim of this project is to develop an autonomous chat service to act as a counselor to elicit behavioral change and reflection in users regarding their health choices and habits.

Modeling domain knowledge

- Explore languages and technologies to be used to achieve core objectives.
- Research techniques used to build ontologies from datasets.
- Develop web-scraping program to gather domain knowledge from popular user outlets.
- Clean the data, and manually build initial ontology from data obtained.
- Verify that the ontology relationships are correct through unit testing.
- Research emotion-based ontology to improve message selection when no concepts detected.

Develop chat system

- Manually write a list of varying responses to core health concepts based on BMI techniques.
Note: auto generation of responses is outside the project's scope.
- Devise a method for selecting responses based on user message context determined by domain-specific ontology.
- Manually improve ontology where any noticeable relationships or concepts do not exist.

Design & develop user interface

- Interface to enable a user to enter text (free-form), and view the chat agents' responses.
- The user messages will be stored, and later used to improve the domain-specific ontology.
- Have a separate *test instance* of the web application to allow users to rate each response as appropriate to the context of their previous messages – to facilitate usability testing.

Usability testing

- Crowd source user participation via social networking – Twitter/Facebook/Reddit.
- Allow users to rate each response as appropriate to the context of their messages, associating the context identified with their message.
- Devise algorithm to process user messages corpus to improve domain-specific ontology.

Work plan

Supervisor meetings

Weekly review meetings have been scheduled to take place each Thursday at 12:30 to discuss projects progress. Two longer review meetings are planned to take place during week 5 and 10.

Weekly plan

Week 1 – 26/01/15: **Initial research and project report**

Week 2 – 02/02/15: **Modeling domain knowledge**

- Research ontological language and techniques to use for cleaning, storing, and querying data.
- Begin scraping domain-specific (health/obesity) data from various web sources.
- Develop small simulation of desired language/techniques to use to ensure they're appropriate.

Week 3 – 09/02/15: **Modeling domain knowledge**

- Apply techniques to clean, and store domain-specific corpus acquired from web scraping.
- Verify ontological relationships and querying via unit testing.

Week 4 – 16/02/15: **Develop chat system**

- Manually write BMI focused open-ended questions for each main ontological concept (parent).
- Manually improve ontology where holes are noticed in domain knowledge or relationships.

Week 5 – 16/02/15: **Develop chat system**

- Devise algorithm to categories and infer context of user message. Use this knowledge to select an appropriate context-dependent response.
- Manually create user-responses and simulate algorithm via unit testing.

Week 6 – 02/03/15: **Design & develop user interface**

- Create database to store user messages, associated with user information and context determined from aforementioned algorithm. Include fields used for usability testing.
- Develop separate frontend to include components used for usability testing.

Week 7 – 09/03/15: **Usability testing**

- Ensure a snapshot of ontology is taken for comparison of model *before* user participation.
- Launch website and advertise to drive traffic through social media, peers and university email.

Week 8 – 16/03/15: **Usability testing**

- Ensure a snapshot of ontology is taken for comparison of model *during* user participation.
- Devise algorithm to process user messages corpus to improve domain-specific ontology.

Week 9 – 23/03/15: **Usability testing – analysis results of ontology improvements.**

- Analyze results of improvements to ontology through user participation.

Week 10 and 11 – 30/03/15: **leeway and final report**

References

- [1] Office for National Statistics. Mortality statistics: deaths registered in England and Wales. [Online] Available from: <http://www.ons.gov.uk/ons/rel/vsob1/mortality-statistics--deaths-registered-in-england-and-wales--series-dr-/2012/index.html> [Accessed 29 January 2015]
- [2] Miller W, Rollnick S. Motivational Interviewing: preparing people for change. 2002.
- [3] Bickmore T, Schulman D, Shaw G. A reusable framework for health counseling dialogue systems based on a behavioral medicine ontology. 2011.