CSC3094 Major Project and Dissertation in Computer Science Project Proposal
'Lexicon Construction for Personality Traits and Human-like Attributes from Classic English Literature'

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Motivation and Rationale

Context

Lexicon construction focuses on the creation of a comprehensive list of words and phrases used in a specific language or domain, along with information about their meanings, relationships, and usage[9]. An effective lexicon functions as a road-map for language, assisting in navigating complex relationships between words and phrases and comprehending their meanings and nuances. The construction of a lexicon can lead to an improvement in NLP systems, such as machine translation[10], word sense disambiguation[11], and word embeddings[12], enabling these systems to better comprehend the meaning of words and phrases and generate more accurate and nuanced translations, classifications, and representations of language. A comprehensive lexicon of personality traits can provide a foundation for chatbots to understand and analyse the emotions[13], motivations, and personalities of individuals in a more accurate and nuanced manner.

Problem

Chatbots have revolutionized the way we interact with customer service for many major industries, providing instant and convenient access to information and services. However, despite their many benefits, chatbots still face significant challenges in accurately accounting for human emotions and personality traits. This is a major problem as it limits the ability of chatbots to provide a personalized and empathetic user experience[7]. One of the main challenges in this area is the lack of a comprehensive lexicon of personality traits. Without a well-defined and comprehensive lexicon of personality traits, chatbots are unable to accurately analyse and understand the emotions and motivations of individuals. This can lead to misunderstandings and inappropriate responses[8] (GPT-3 outputs 'toxic' responses), which can result in a negative user experience.

Rationale

In my project, I aim to advance the field of natural language processing (NLP) by constructing a comprehensive and accurate lexicon of personality traits. This lexicon will be used by chatbots to better understand and respond to human emotions and personalities, leading to more engaging and satisfying interactions. I plan to achieve this goal by reproducing and adapting upon existing state-of-the-art methods for lexicon construction and set expansion. Furthermore, I aim to make the lexicon construction process user-friendly by developing a simple interface, making the process easier to understand through an interactable interface. My contribution to NLP through this project will provide a solid foundation for the development of a comprehensive and accurate lexicon of personality traits, leading to improved chatbot capabilities and user experience.

Aim and Objectives

The main objective of this project is to develop a tool for the construction of a lexicon which accurately extracts words describing personality traits and human attributes from classic English literature. This tool will be based on existing methods in lexicon construction and set expansion in the field of natural language processing (NLP) and will feature a user-friendly interface to make the lexicon construction process easily understandable.
To evaluate the accuracy of the tool, a multi-step evaluation process will be employed. This process will include a comparison with the best methods, and a manual review of the lexicon produced by the proposed tool. The manual review of the lexicon will validate that the words produced by the tool accurately reflect personality traits and human attributes.

Objectives:

1. **Analyse and summarise 10 to 20 research publications in Lexicon Construction, and Set Expansion.**

   Conducting a literature review provides an overview of the current state of the field and allows for a better understanding of the existing methods for lexicon construction and set expansion. This is important in order to identify potential gaps in knowledge and areas for improvement.

2. **Acquire and pre-process a substantial corpus of 20 to 50 text sources in classic English literature with characters that have well known-personality traits.**

   Conduct a review of classic English literature, consulting expert sources, and searching online databases. Once the text sources have been selected, they will be stored in a machine readable format (accessible and readable by a python file) for pre-processing. Pre-processing will be conducted to enable the text sources to be input to machine learning and statistical models to produce a lexicon construction tool. Pre-processing involves cleaning the text sources, such as removing punctuation, calculating stemming words, and overall removing irrelevant information in the text.

3. **Reproduce and adapt state-of-the-art methods in lexicon construction and set expansion for personality trait extraction.**

   Thoroughly understand each research paper in the literature review to implement the algorithms and methods described. Validate my implementation by reproducing the evaluation methods using their stated data-sets. Achieve successful reproduction of state-of-the-art research to adapt the work to the project's aim.

4. **Conduct a multi-step evaluation process, including comparison with the best methods and manual review of the lexicon.**

   Fairly conduct a wide range of identical tests on each of the reproduced methods for lexicon construction and set expansion to compare results and determine which method is best for extracting personality traits and human-like attributes. Also conduct manual observation tests to validate the outputs of each method to ensure validity of the results. Implement commonly used evaluation metrics such as F1, recall, precision, accuracy, and any other metrics applicable found in the research papers to collect respectable results from testing.

5. **Contribute to the field of Natural Language Processing (NLP) by developing a tool that accurately extracts personality traits and human-like attributes from text sources.**

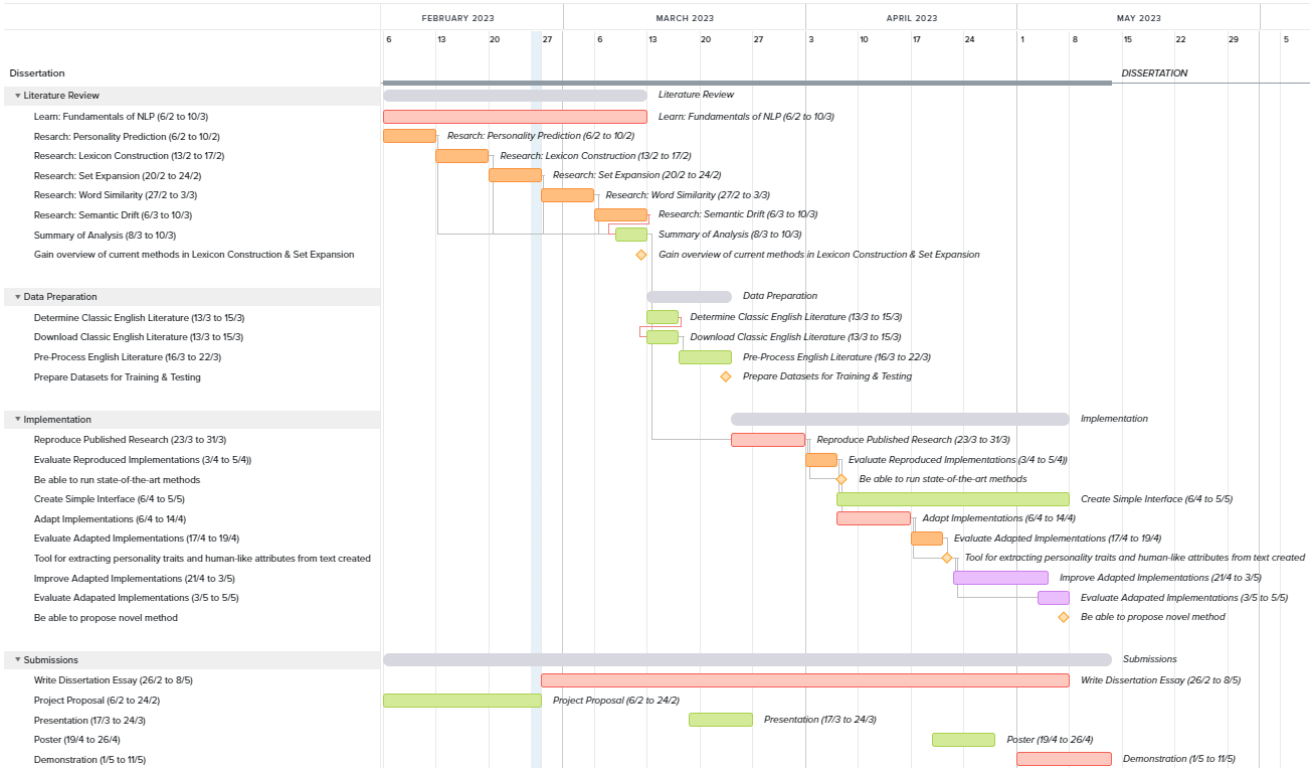
   Determine the best existing method by comparing the state-of-the-art methods in lexicon construction and set expansion tailored to personality traits and human-like attributes. Through rigorous evaluation of reproduced methods present the best method tailored to my category. Analyse the strengths and weaknesses of the best method and determine how it can be improved upon. To contribute to the field of NLP, document my overall analysis to present and publish my research. If possible, implement and thoroughly evaluate my proposed improvement to present a novel method that incorporates the best aspects of existing methods and addresses any identified weaknesses.

Background

Resource Name	**Summary**	**Relevance**
ALOHA: Artificial Learning of Human Attributes for Dialogue Agents **(2021)**[2]	This paper presents a new approach for building human-like dialogue agents by using Human Level Attributes (HLAs), which are recurrent characteristics of fictional characters known as tropes. The authors introduce the ALOHA system, which combines three components to build a character-specific language model: Character Space Module (CSM), Character Community Module (CCM), and Language Style Recovery Module (LSRM). The experiments show that ALOHA outperforms baseline models and is stable regardless of the character's identity, genre, and context.	My project aims are similar to the use of HLAs in this paper. By creating a lexicon of personality traits, the proposed project can also help in constructing human-like dialogue agents. My proposed project could build upon the work presented in this paper by using the lexicon of personality traits to determine the HLAs of characters in classic English literature, leading to the construction of more sophisticated and human-like dialogue agents.

The state-of-the-art in text-based automatic personality prediction **(2022)**[5]	This paper reviews natural language processing approaches to Automatic Personality Prediction (APP) since 2010, with a focus on text-based data.	This paper provides the strengths and limitations of existing methods in automatic personality prediction. Additionally, the review of previous works can inform the design of the models and experiments to evaluate the effectiveness of my proposed tool.
Corpus-based Set Expansion with Lexical Features and Distributed Representations **(2019)**[1]	The paper presents the CaSE framework, a set expansion method for entity recognition. The framework is a combination of lexical context matching and semantic matching, where lexical features are used to match the textual context of entities and distributed representations are used to capture the semantic similarity between entities.	The paper provides a state-of-the-art method for set expansion and can be used as a reference to guide the development of the lexicon construction tool in the project proposal.
Am I who I say I am? Unobtrusive self-representation and personality recognition on Facebook **(2017)**[6]	This paper studies the impact of self-representation on social media platforms on personality recognition and proposes a boosted regression model to address this issue. The model classifies the Five Factor personality model with an average accuracy of 74.6 percent.	This paper achieves a similar goal to my aim as it presents a practical approach to developing a system that can extract personality traits from text sources. The approach used in this paper is boosted regression modelling which I can test and modify to suite the aim of my project. Their use of LIWC sentiment categories as predictors in the regression model highlights the importance of considering sentiment analysis via various other NLP techniques.
Learning from Negative Examples in Set Expansion **(2011)**[4]	The proposed method combines a centroid-based approach with the incorporation of negative examples, which are treated as "experts" indicating for or against the membership of an entity in the expanded set. The final score of an entity is calculated as the sum of rewards or penalties received from positive and negative examples, based on the rank of the entity in the corresponding lists.	This paper is relevant as it presents a novel and effective method for set expansion that could be adapted and reproduced for the construction of a lexicon of personality traits. The incorporation of negative examples in this method could be useful in ensuring the accuracy of the lexicon construction process. The use of the MAP metric for evaluation could also provide a useful reference for evaluating the accuracy of the lexicon construction process.
Noun-phrase co-occurrence statistics for semi-automatic semantic lexicon construction **(2000)**[3]	This paper discusses a method for building a semantic lexicon, which is a mapping of words to their meanings. The method described in the paper involves counting the co-occurrence of noun phrases in a corpus of text and using the resulting co-occurrence statistics to construct a lexicon.	Despite this paper being quite old, this paper can be checked for future work through citations and guide my literature review. Also, the information in this paper can be used to identify patterns and relationships between words and phrases, including those related to personality traits and human-like attributes. This method may have been improved in future work which could be adapted to fulfill my aim.

Work Plan



Plan Structure

The diagram above and detailed phases below specify how the project will be carried out, it enables myself and my supervisor to track my progress and what to expect each week. Each of the tasks are broken down and linked to each other through their dependencies and contributions to the project. Some tasks overlap as they can be conducted in parallel to save time and prevent myself from experiencing burnout. Lastly, milestones indicated by yellow diamonds represent major moments of progress in the project which provide an overall goal for myself to work towards for each phase.

Phases

As my project aims to construct a comprehensive and accurate lexicon of personality traits for natural language processing (NLP) applications. I will begin my project with a literature review to gain an overview of the fundamentals of NLP, personality prediction, lexicon construction, set expansion, word similarity, and semantic drift. From my review I will summarize my findings to guide the development phase of my project.

In the next phase, the project will focus on data preparation, where classic English literature will be determined, downloaded, pre-processed into datasets for training and testing.

The implementation phase will involve reproducing published research, evaluating the reproduced implementations, and being able to run state-of-the-art methods. I will also create a simple interface, adapt the reproduced implementations, then evaluate the adapted implementations (using F1-measure, Recall, Accuracy, and, Precision), and attempt to improve the adapted implementations. The ultimate goal is to propose a novel method for extracting personality traits and human-like attributes.

Risk and Contingencies

I have identified the following risks: limited understanding of NLP fundamentals may hinder the ability to carry out the literature review and research effectively. Reproduction of published research may not be successful, leading to difficulties in evaluating and adapting implementations. The process of creating a simple interface and adapting implementations may be time-consuming and challenging. The proposed novel method may not perform as expected.

I have created the following contingencies to address the mentioned risks: I am prepared to allocate additional time and resources to learning NLP fundamentals if necessary. I have allocated time to review and understand the published research thoroughly before attempting to reproduce it. I've set realistic timelines and allocated adequate resources for the interface creation and adaptation process. I have planned to conduct thorough testing and evaluation of the proposed novel method to identify any issues early on.

Ethics

My project:

1. Will not involve working with animals or users/staff/premises of the NHS
2. Will be carried out within the European Economic Area
3. Will not have any impact on the environment
4. Will not work with populations who do not have capacity to consent
5. Will not involve work with human tissues
6. Will not involve work with vulnerable groups (Children/Learning disabled/Mental health issues, etc.).
7. Will not involve any potentially sensitive topics (Examples include but are not exclusive to body image; relationships; protected characteristics; sexual behaviours; substance use; political views; distressing images, etc.)
8. Will not involve the collection of any identifiable personal data

References

[1] Yu, P. et al. (2019) Corpus-based set expansion with lexical features and distributed representations: Proceedings of the 42nd International ACM SIGIR Conference on Research and Development in Information Retrieval, ACM Conferences. Available at: https://dl.acm.org/doi/10.1145/3331184.3331359 (Accessed: February 23, 2023).

[2] Li, A.W. et al. (2021) Aloha: Artificial Learning of human attributes for dialogue agents, arXiv.org. Available at: https://arxiv.org/abs/1910.08293 (Accessed: February 23, 2023).

[3] Roark, B. and Charniak, E. (2000) Noun-phrase co-occurrence statistics for semi-automatic semantic lexicon construction, arXiv.org. Available at: https://arxiv.org/abs/cs/0008026 (Accessed: February 23, 2023).

[4] Jindal, P. (2011) Learning from negative examples in set-expansion. Available at: http://sharps.org/wp-content/uploads/JINDAL-ICDM.pdf (Accessed: February 23, 2023).

[5] Feizi-Derakhshi, A.-R. et al. (2022) Text-based automatic personality prediction: A bibliographic review, arXiv.org. Available at: https://arxiv.org/abs/2110.01186 (Accessed: February 23, 2023).

[6] M. Hall and S. Caton, "Am I who I say I am? Unobtrusive self-representation and personality recognition on Facebook," PLOS ONE, vol. 12, no. 9, p. e0184417, Sep. 2017,
Doi: https://doi.org/10.1371/journal.pone.0184417.

[7] J. Anderson and L. Rainie, "3. Improvements ahead: How Humans and AI Might Evolve Together in the next Decade," Pew Research Center: Internet, Science and Tech, Dec. 10, 2018.
https://www.pewresearch.org/internet/2018/12/10/improvements-ahead-how-humans-and-ai-might-evolve-together-in-the-next-decade/ (Last accessed on 6th of February 2023)

[8] Ouyang, L. et al. (2022) Training language models to follow instructions with human feedback, arXiv.org. Available at: https://arxiv.org/abs/2203.02155 (Accessed: February 23, 2023).

[9] Evans, V. (2010) How words mean: Lexical concepts, cognitive models, and meaning construction. Oxford: Oxford University Press.

[10] Arthur, P., Neubig, G. and Nakamura, S. (2016) Incorporating discrete translation lexicons into Neural Machine Translation, arXiv.org. Available at: https://arxiv.org/abs/1606.02006 (Accessed: February 23, 2023).

[11] University, M.G.C. et al. (2003) Improving word sense disambiguation in lexical chaining: Proceedings of the 18th International Joint Conference on Artificial Intelligence, Guide Proceedings. Available at: https://dl.acm.org/doi/10.5555/1630659.1630906 (Accessed: February 23, 2023).

[12] Tissier, J., Gravier, C. and Habrard, A. (no date) Dict2vec : Learning word embeddings using lexical dictionaries, ACL Anthology. Available at: https://aclanthology.org/D17-1024/ (Accessed: February 23, 2023).

[13] Pamungkas, E.W. (2019) Emotionally-aware chatbots: A survey, arXiv.org. Available at: https://arxiv.org/abs/1906.09774 (Accessed: February 23, 2023).