AI & Robotics Project Proposal

Project Title: Opinion forming Interactive AI based on NLP, focussed on World Economics and Politics

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Project Category:

- Artificial Intelligence (AI), NLP/NLU/NLG

Project Aim:

- Successfully build an AI that can form opinions on a given subject matter from knowledge database and have conversations.
- Significance:- Enhance HCI making every interaction with AI unique and relevant. This AI will have deep understanding of topics of discussion from world economics and politics. This enables people to have human like conversation and get opinion of AI based on facts. Also, it expands accessibility for wider community, while reducing effort and resolution time.
- Relevance:- NLP, NLU, knowledge base building, much better performance, and user satisfaction than rule based chatbots.

Related Work:

Opinion generation is hot topic in the field of NLU for AI. Building an AI which can plan and choose how to respond to the environment in the form of NLU is a challenge, scholars around the world are working on. These decisions making techniques are based in both real-world data and on the options of the programmers and engineers. However, what's interesting is talking about the intellectual capacity to feel, to understand life and human world.

Some notable work is done in this field, and they are, [2] which discusses on giving generating prior opinion using the Neural Network and then train it by collecting opinions from 5 different users and updated its internal neural network to match the opinions. Authors propose to use an attention-based abstract generation model — a data-driven approach trained to generate informative, concise, and fluent opinion summaries.

Next work is [1], authors present an attention-based neural network model that can absorb information from multiple text units to construct informative, concise, and fluent summaries. An importance-based sampling method is designed to allow the encoder to integrate information from an important subset of input. This system is also rated as more informative and grammatical in human evaluation according to the paper.

The work [3] is by far one of the most advanced and is based on multiple transformer models which addresses problems of dialogue, discussion. This paper examines several diverse aspects of intelligence and summarises the key results. The model known as *Gopher* lifts the performance over current state-of-the-art language models across roughly 81% of tasks containing comparable results, notably in knowledge-intensive domains such as fact checking and general knowledge.
Next work [5] defines a generative model for a review collection which capitalizes on the intuition, when generating a new review given a set of other reviews of a product with control of uniqueness. Results show that the model is capable to produce fluent and coherent summaries reflecting common opinions.
In the paper [7] authors propose a sentence ordering system. Training is done for feature extraction for main sentence to be the claim and next sentences are ordered based on a ranking by the system.
The next work [8] an attention-based network is proposed to absorb information from multiple text units to construct informative, concise, and fluent summaries using importance-based sampling designed to allow the encoder to integrate information.
Authors in paper [6] purpose an attention-based encoder and decoder system for opinion question generation problem for interacting with customers in online shopping platforms. The model can identify key parts of the sentences and generate questions that are non-redundant relevant to the user.
The paper [9] presents a unique approach to opinion-based text generation that non-text data such as image and metadata also contains extra information, hence a multi modal system opinion summarization framework is created. The framework obtains a representation of each modality using a separate encoder for each modality, and the text decoder generates a summary. First an encoder is created for text only then a separate encoder for image, then finally a decoder for text output. Framework training is done end-to-end by combining all modules.
Thus, there is still scope for opinion-based systems to improve and build upon specific domains especially generating opinionated conversational sentences and I intend to work on this in my project.

Project Objectives/Deliverables:

- Study and implement state-of-the art models used in sentence generation, opinion generation and build conversational logic.
- Implement Tokenization, Word embedding, LSTM(*Done*), Transformers(*In Progress*), BERT, Attention Networks and design a unique Opinion Generational Multi-Model systems for NLU.
- Create a personalized dataset and update model based on existing conversational AI by Transfer learning.

Methodology:

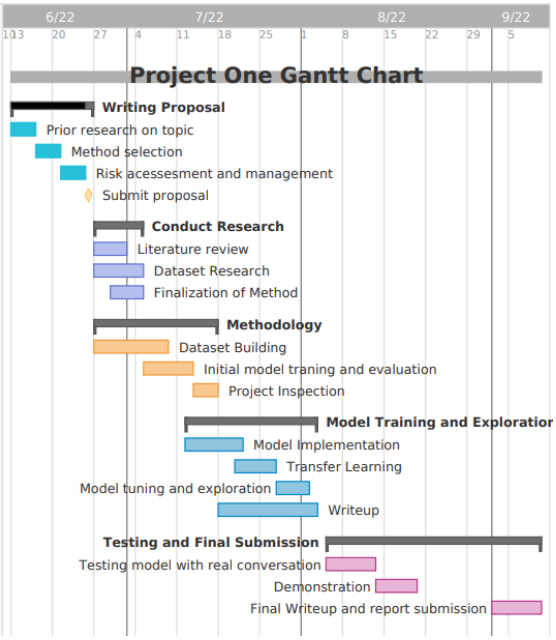
- Create a new dataset by building upon existing datasets for conversational AI.

- Create a knowledge database based on the subject topic dataset.
- Create a sentence ranking for fact presentation and then generate the opinion summary based on facts.
- Create a text sequence to sequence generation model to have conversations and include the generated opinion as part of speech (BERT, missing text filling)
- Learn, create, apply, and evaluate Transfer Learning(*In Progress*) and Active Learning concepts from created dataset to pre-trained models. (*TBD*)

Project Plan:

- Feasibility:- Having a background in Electronics and Communication and worked on a software development before, but the multi-model part is bit challenging, but I am confident that I have the software skills need to do this project successfully.
- Resources:- Need school GPU resources of around 60 hours to train model.
- Self-explanatory Gantt Chart for project progress

Project One Gantt Chart	start	end	10%
Writing Proposal	**13/06/22**	**24/06/22**	**90%**
Prior research on topic	13/06	15/06	100%
Method selection	16/06	20/06	100%
Risk acessesment and management	21/06	23/06	100%
Submit proposal	24/06	24/06	0%
Conduct Research	**27/06/22**	**04/07/22**	**0%**
Literature review	27/06	30/06	0%
Dataset Research	27/06	04/07	0%
Finalization of Method	29/06	04/07	0%
Methodology	**27/06/22**	**15/07/22**	**0%**
Dataset Building	27/06	07/07	0%
Initial model traning and evaluation	05/07	12/07	0%
Project Inspection	13/07	15/07	0%
Model Training and Exploration	**12/07/22**	**02/08/22**	**0%**
Model Implementation	12/07	20/07	0%
Transfer Learning	20/07	26/07	0%
Model tuning and exploration	27/07	01/08	0%
Writeup	18/07	02/08	0%
Testing and Final Submission	**04/08/22**	**08/09/22**	**0%**
Testing model with real conversation	04/08	11/08	0%
Demonstration	12/08	18/08	0%
Final Writeup and report submission	01/09	08/09	0%



Risks and contingency plan:

- Challenges:- Not enough dataset for building the knowledge database, resulting the AI may not be able to cover broader range of user inquires and may fail to produce desirable results, leading to bad und user experience and these need to be programmed to be dealt with.
- Difficult aspects:- Slang and unscripted language, grammar, emotions, tone, and sarcasm make it difficult for conversational AI to interpret the user meaning and respond appropriately thus not be able reflect ideas clearly due to limited training and may need more clear description from users.
- Contingency:- A fall back plan would be to create knowledge database and present it to user based on conversation with limited opinion forming capabilities at least successfully.

Hardware/Software Resources:

- Software Resources:- Python 3.x, TensorFlow, Jupyter Notebook
- Hardware Resources:- CUDA enabled NVIDIA GPU with High VRAM for model training
- Requested access for University GPU to supervisor.

Data:

- Some data is available in form of movie dialogues, Reddit discussions and Amazon Reviews which can be used to train for normal conversations and early opinion generation. [6]
- Web scrapping of interviews data and topic knowledge is required to further build on this dataset. [5]

References:

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4. Wagner, D.N. Economic patterns in a world with artificial intelligence. Evolut Inst Econ Rev 17, 111–131 (2020). https://doi.org/10.1007/s40844-019-00157-x
5. Unsupervised Opinion Summarization as Copycat-Review Generation (Bražinskas et al., ACL 2020)
6. Automatic Opinion Question Generation (Chali & Baghaee, 2018)
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8. Neural Network-Based Abstract Generation for Opinions and Arguments (Wang & Ling, NAACL 2016)
9. Self-Supervised Multimodal Opinion Summarization Im et al., ACL 2021 https://aclanthology.org/2021.acl-long.33
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