AI/Data Science Professional COSC2778/COSC2792/COSC2818

Thu 4:30- Group 1

Project Proposal

Improving Transparency and Interoperability of Heathcare AI systems

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Introduction

Eric Cheung

- Better clinical decision and user experiences
- Stakeholders
- Pain points
- Digital Trust and Responsible AI are important

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Problem Definition

Luke Dale

Interoperability

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Image: https://www.iqvia.com/insights/the-iqvia-institute/reports/the-growing-value-of-digital-health

Problem Definition

Luke Dale

Interoperability

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Image: https://www.pexels.com/photo/photo-of-doctor-examining-patient-7088829/

Problem Definition

Luke Dale

Interoperability

Solutions are required which:

- Support greater interconnectivity between data infrastructures
- Standardise semantics and syntax
- ”Democratise” access to healthcare data

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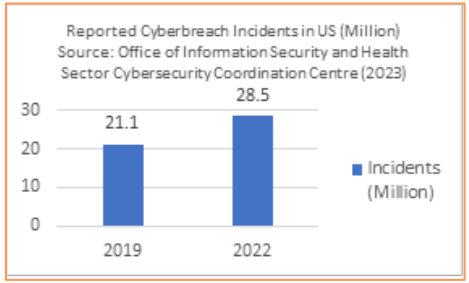
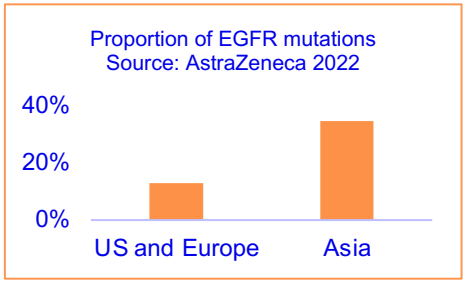
Problem Significance

Eric Cheung

- Privacy and cybersecurity
- Transparency
- Train data availability





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Proposed Data-Driven Solution

Eric Cheung

- Consolidation and Coordination
- WHO – new regulatory and guideline standard
- Ethical concerns – resources to implement
- Job security concerns
- Education

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Methodology

Mrwan Fahad A Alhandi

8 Core Principles for AI

1. Generates net-benefits
2. Do not harm
3. Regulatory & legal compliance
4. Privacy protection
5. Fairness
6. Transparency & Explainability
7. Contestability
8. Accountability

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Methodology

Mrwan Fahad A Alhandi

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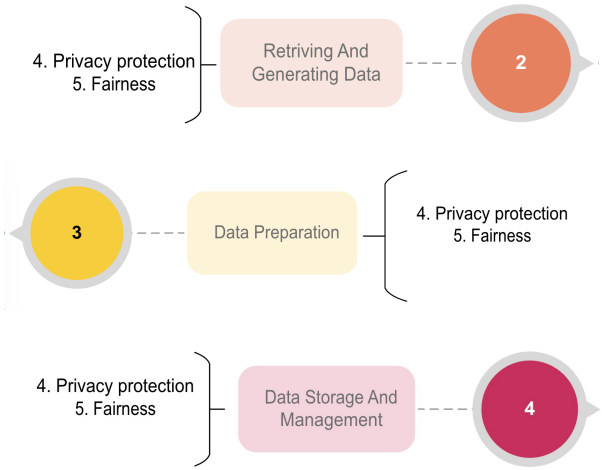
Methodology

Mrwan Fahad A Alhandi



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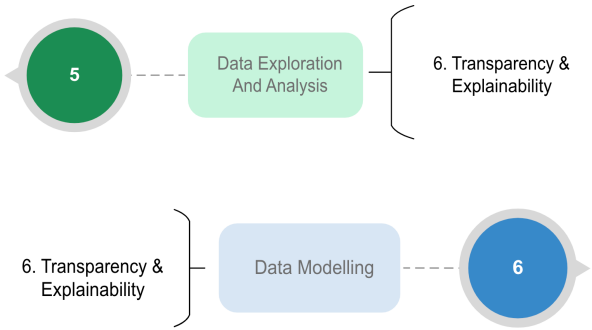
Methodology

Mrwan Fahad A Alhandi



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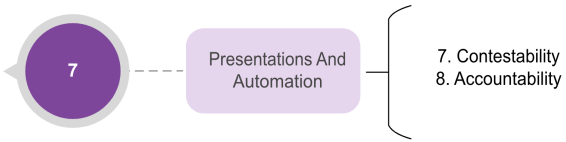
Methodology

Mrwan Fahad A Alhandi



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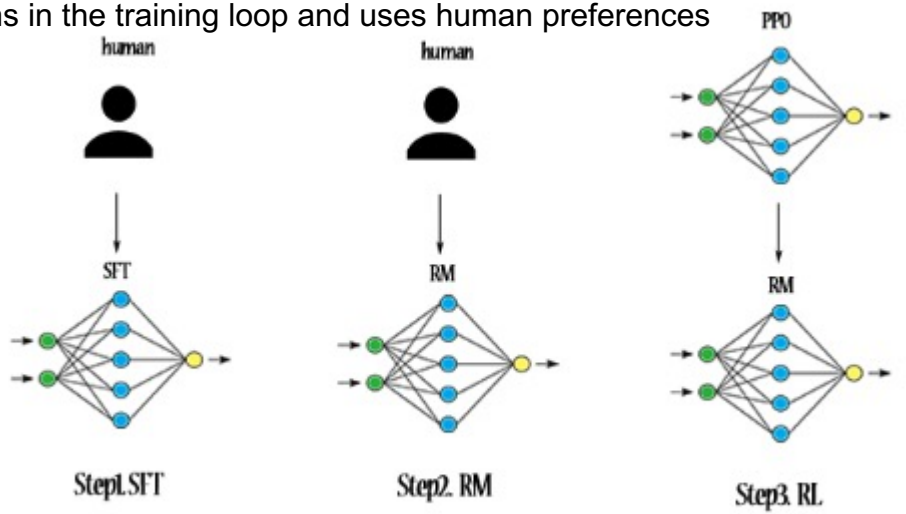
Design Prototype - LLMs

Richard Doherty

- LLMs – Large Language Models. The ability of OpenAI's LLM-enabled ChatGPT to engage in human-like conversations is now widely known and accepted and will influence future user expectations for all products.

- *"LLMs have shown remarkable capabilities in a wide range of NLP tasks. However, these models may sometimes exhibit unintended behaviours, e.g., fabricating false information, pursuing inaccurate objectives, and producing harmful, misleading, and biased expressions. (La Vivien, 2023)."*

- To address these key trust-related concerns (especially in the context of Healthcare AI systems), we propose that the technique of Reinforcement Learning with Human Feedback (**RLHF**) be embedded in the training methods of Healthcare AI systems. RLHF incorporates humans in the training loop and uses human preferences as a "reward signal" to fine-tune LLMs. (La Vivien, 2023).



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Design Prototype – RLHF steps

Richard Doherty

(La Vivien, 2023)

1. Supervised fine-tuning (**SFT**)

“Collect demo data & train a supervised policy. Labellers provide desired behaviour demos on input prompt distribution. Team fine-tunes a pretrained GPT-3 model on this data using supervised learning."

2. Rewording model training (**RM**)

“Collect comparison data and train a reward model. The team collects a dataset of comparisons between model outputs, where the labellers indicate which output, they prefer for a given input. Then trains a reward model to predict the human-preferred output.”

3. Reinforcement Learning fine-tuning (**RL**)

*“Optimize a policy against the reward model using **PPO**. The team uses the output of the RM as a scalar reward. Then fine-tunes the supervised policy to optimize this reward using the Proximal Policy Optimization PPO algorithm."*

"Steps 2 and 3 are iterated continuously; more comparison data is collected on the current best policy, which is used to train a new RM and then a new policy. In practice, most of comparison data comes from supervised policies, with some coming from PPO policies.” (La Vivien, 2023)

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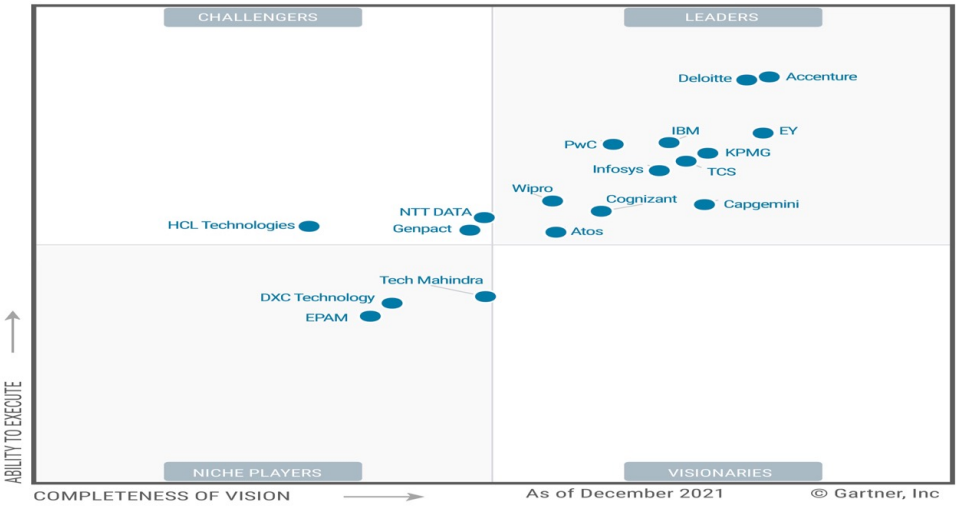
Richard Doherty

Conclusion

- Incorporation of our proposed use of LLMs and most importantly, RLHF, to be further defined and stated within the guidelines specified by governing bodies such as WHO referenced in our problem definition above.
- Progression through a full Data Science Lifecycle with emphasis on the ***Eight Core Principles of AI*** discussed in the Methodology section above should be included as part of any Heathcare AI system development.

- The global consulting firms highlighted in the Gartner Magic Quadrant for Data and Analytics service providers should all be well positioned to help make sure the guidelines from the WHO become best practice and measure up to generally accepted international standards for future AI audit and compliance.

Figure 1: Magic Quadrant for Data and Analytics Service Providers



Source: Gartner (February 2022)

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