Towards Culturally Responsive Educational AI

Alden Arciaga

Advised by: ***Dr. Sadia Sharmin***

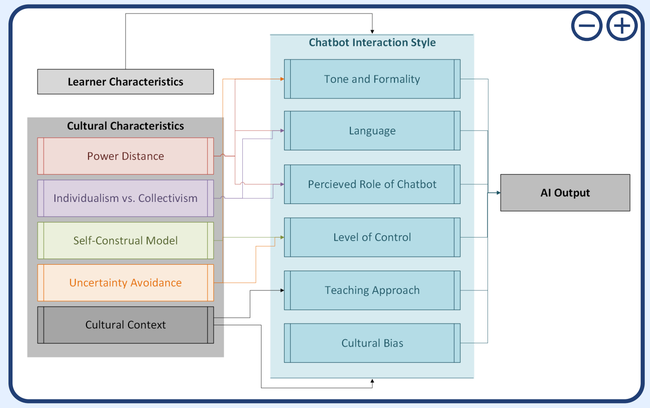
1) Background

Generative AI enables **personalized education** but often **reflects Western norms**, limiting global relevance. I propose a framework for culturally adaptive chatbots and prototype a model using the framework.

2) Framework

The framework links culture to chatbot interaction using cultural vectors—numerical representations of **power distance**, **individualism**, **self-construal**, and **uncertainty avoidance** (Hofstede, 2011; Markus & Kitayama, 2014). Cultural vectors control **tone, formality, language**, **perceived role of chatbot**, and **level of control.**

Canada's Vector: [0.39, 0.80, 0.80, 0.48]



3) Prototyping

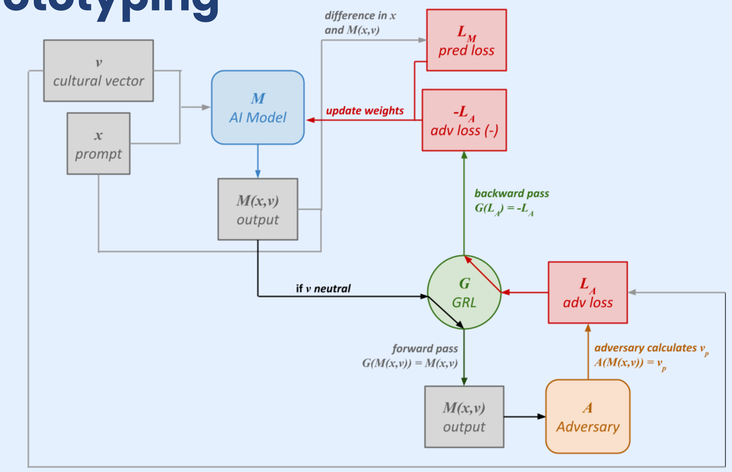


Figure 1: Training Loop

DeepSeek 7B was used as the base AI model for accessibility reasons. **LoRA finetuning** was employed to allow the chatbot to adapt its communication style based on cultural vectors that were tagged onto prompts. **Adversarial debiasing** was used to mitigate bias.

4) Evaluation

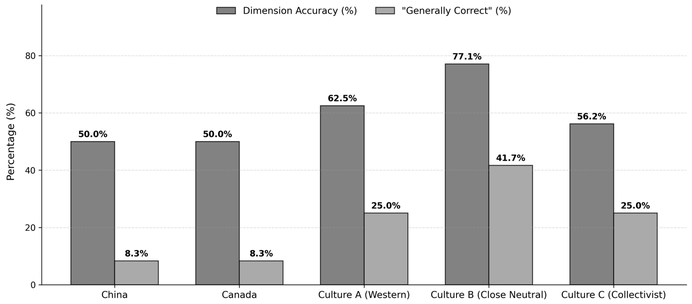


Figure 2: Cultural Accuracy Across Six Cultures

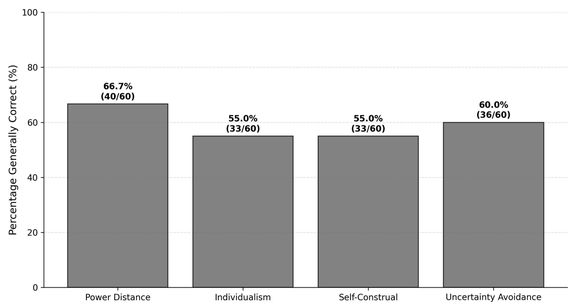


Figure 3: Cultural Vector Accuracy

Thematic analysis was done on 72 responses that were tagged with six unique cultural vectors. Found that **59.2%** of the time, the model expressed an aspect of the culture vector correctly with statistical significance. However, the model was factually accurate **38.9%** of the time.

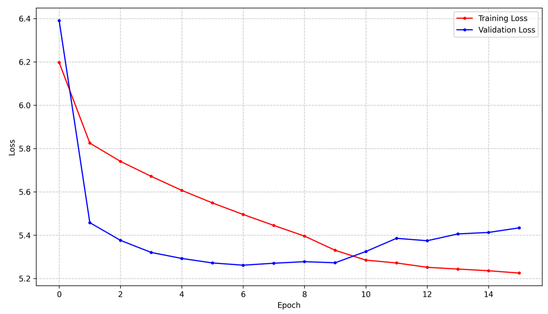


Figure 4: Training and Evaluation Loss

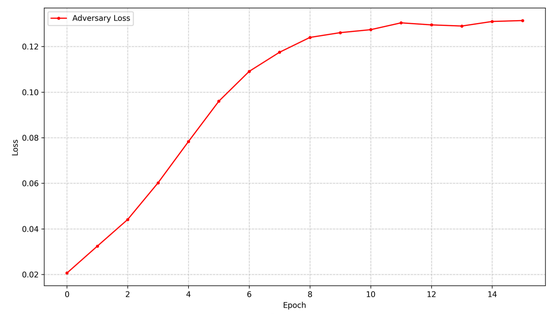


Figure 5: Adversary Loss

Training analysis found the main evaluation loss decreased from **6.39** to **5.27** and the adversary loss increased by **~300%**. Indicates the model **learned** and has been **debiased** to a certain extent.

5) Conclusion + Next Steps

Cultural vectors are an effective way to make culturally adaptive AI. Future work can involve **expanding training datasets**, involving **experts** with **diverse cultural backgrounds**, and classroom testing.

LAIDLAW SCHOLARS

UNIVERSITY OF TORONTO

Thank you to the University of Toronto Laidlaw Scholars Programme for supporting this research. Huge thank you to my advisor as well!

Hofstede, G. (2011). Dimensionalizing cultures: The Hofstede model in context. ORPC, 2(1), 8.

Markus, H. R., & Kitayama, S. (2014). Culture and the self. In College Student Development and Academic Life (pp. 264–293). Routledge.