Cover Letter

My name is <u>Changhun Lee</u>, a Postdoctoral Associate in the Graduate School of Artificial Intelligence at UNIST (Ulsan National Institute of Science and Technology). I recently received my Ph.D. degree with the thesis titled *"Tackling Three Problems in Controlled Sequence Generations: Bridging Reinforcement Learning with Language Models."* Based on my achievement and deep interest in the interplay area between natural language generations and reinforcement learning (RL), I would love to expand the theoretical horizons of machine learning and contribute to the advancement of our knowledge from natural to social sciences.

My academic journey at UNIST has deepened my knowledge in artificial intelligence, and I'm eager to bring my experience and expertise to the below topics..

- Optimality

  As sectors like autonomous driving and healthcare increasingly rely on AI, the controllability of AI becomes crucial, especially in unexpected situations. My research in this domain focuses on ensuring that AI can handle such challenges. Specifically, I look into the theoretical understanding and guarantee of AI's controllability from its reward or cost function perspective. By delving into the Pareto optimality between likelihood and reward objectives through bi-objective/bi-level optimization, I aim to develop models that guarantee optimal control.

- Dynamics

  AI models of our daily lives, such as ChatGPT, Youtube recommendation, and Google Search, are constantly adjusting their parameters based on user feedback. This continuous adaptation presents challenges, both in terms of ensuring models reflect the user's original preferences and in re-fitting model parameters according to users' changing preferences driven by interaction with AI models. To address these challenges, I'm grounding my research in the Hamilton-Jacobi-Bellman equation to achieve necessary and sufficient conditions for dynamic control.

- Equilibrium

  Recognizing that user preferences can shift and consequently requires to change the reward objectives along with it, it's important for generative models to be adaptable to such a change in reward objectives. My work here focuses on ensuring the generative models can achieve an optimality reacting to dynamic reward objectives. By defining a likelihood-based generation function and a reward-based control function, I aim to establish a model and makes it learn from the equilibrium between those two functions, ensuring a balanced generation-control dynamics.

For a detailed overview of my work, please visit my website: https://chlee-leo.github.io/. I believe my research and its applications will align well with generative model, language model, reinforcement learning, control theory, game theory, etc., and I look forward to discussing how I can collaborate with amazing colleagues regarding those research topics..

Alfred Marshall's words, *"Cool head, but warm heart!"* guide my approach in research and collaboration. I hold a steadfast commitment to challenging prejudice and inequality, and this perspective drives me to be an ethical and rational scientist. I hope to have the opportunity to work with amazing colleagues.