Diversity and Inclusion Statement

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This statement shares my values on diversity and inclusion. I argue that science and engineering should be more inclusive to the underrepresented group in university. This (1) improves the equality of the chance for success between the talented and those have been not able to get exposed to advanced technology at an early age; (2) helps research teams collaborate more productive and efficient with members of larger diversity reciprocating each other. To help improve status quo, I launched a platform that aims to integrate resources for research internship, research projects, and learning materials, to help students from the underrepresented group access to research projects that fit their interest and help them progress. I know that my effort is close to nothing. But as a junior researcher whose research career being saved by inclusion, I would continue the mission.

Inequality in sciences and engineering During my undergraduate days, I deeply recognized how much *inclusive* a university majored in sciences and engineering need to be, to support the underrepresented students as possible. The university I attended for undergraduate study, Huazhong University of Science and Technology, is highly competitive in majors such as computer science, electrical engineering, optical science, and mechanical engineering—many students with great talent and passion in technology, which are usually called *nerds* or *geeks*, are admitted into the programs. The talented, most of which are men, usually born into the families of scientists and engineers at highly-developed cities, are the stereotyped template of successful university students—they may start to program on computers play with digital circuits in 5 or 6, while others are just learning elementary arithmetic—you could imagine what a large advantage they are holding even before the start of the program. Given the impressive performance of the talented, the others—the *silent majority*—usually from normal families, with a major part of women student, are highly underrepresented. Such contrast cannot be made up during undergraduate studies, instead, the gap may become wider—(1) The underrepresented may obtain much less implicit academic resources than the talented, *e.g.*, the opportunity to be involved in research projects at a very early stage, although they may work very hard to meet the requirement of labs in subsequent years, they are dominated by the first-mover advantage; (2) The underrepresented may gradually loss the confidence and even become self-doubted, which may crucially suppress their true potential in science and engineering. This is not equal—losing the full game just because falling behind at the starting point? There is not only the talented working with science and engineering.

Science and engineering should be inclusive We need all kinds of people work with science and engineering. Everyone has her unique pros and cons, thus a group with high diversity tend to combine the best (see Fig. 1). For example, some talented students think in the way of *artists*—they make creative breakthroughs in very specific points, but ignore the influence may be brought by the idea to the entire system. Hence, we need someone with the mindset of *engineers* that always keeps the system in mind to evaluate and constraint the work by the former. Such teamwork needs inclusion and diversity.

Time to start to help ourselves I was not in the group of the geeks at the start of university. But fortunately, I kept my long-term goal in mind and launched my own research plan. During designing and implementing computational models, I made great progress in coding and statistical analysis. Suddenly I realized that for us without much project experience, **practice is the only way to get out of the trap**—the trap locked by *no skill so no project* and *no project so no skill*. Hence, we must try our best to help ourselves. The first step is to explore all domains broadly and select a topic that really match our interest or value. This is significant for supporting us to go through hard times. Once set up the mind, try to get involved in related projects as soon as possible. There is no need to worry about requirements on skills—the recursive prerequisite knowledge is infinite, and we learn through solving problems during the project.

Learners' Engineering and Research Network To help more students without specific technical skills in the freshman year, I launched **Learners' Engineering and Research Network (LEARN Lab)**[1], a platform that aims to integrate resources for research internship, research projects, and learning materials. The platform first tries to guide students from the underrepresented group to find the domains and topics of their interest, from general to specific. Then we match the participants with senior graduate students who are volunteering at LEARN Lab. The volunteers will mentor the matched participants with minimal projects as the starting point. The participants usually are able to acquire the requiring skills for the projects quickly, driven by the goal of finishing. A participant finishing the project successfully will be recommended to the principle investigator of the lab that the mentor is working at to start the research career. To note, those labs are generous supporters of our project. LEARN Lab also hosts seminars for women or the underrepresented group to share experience on succeeding science and engineering. Thanks to the highly inclusive nature of LEARN Lab, during about 3 years, over 30 students from the underrepresented group find their own ways in science and engineering.

Inclusion lights my life I was fortunate enough to born into a family of scientists—without getting exposed to advanced technologies at an early age, I was also familiar with big questions in many scientific topics. When I was in junior high school, I was struggled in coursework and wondering: *are there formal ideas that tell us **how** to study?* Such ideas should not be empirical and case-by-case, instead, that should be formal and general. Afterward, my father gave me a book about *Logology*, the study of sciences. I knew that I had found it. I recalled the scientific topics I have been interested in, covering material sciences, linguistics, sociology, and economics—I was so ambitious that I want to improve the progress of all domains in the

[1] Visit LEARN Lab at `l-ear-n.github.io`.

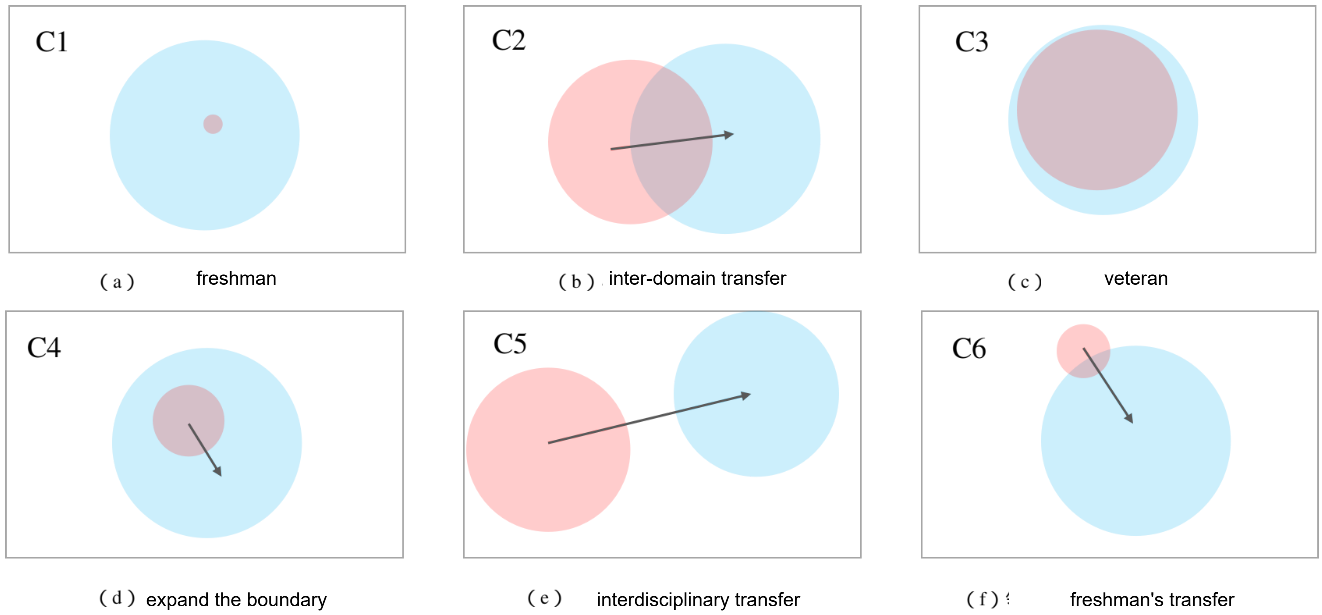

Fig 1: Diverse groups in science and engineering and diverse types of collaboration in science and engineering

sciences—since I not really have the bandwidth to dive into these domains, why not study how people study these domains, to gain insight for improving and automating the domain-specific mindsets? Since then, I made *improving the scientific research* as my long-term goal. I chose the computer science and engineering program for undergraduate study because I wanted to solidate my mathematical foundations. I also thought that advanced artificial intelligence (AI) techniques may help automate scientific research. However, after really working with AI, I realized that current *AI for science* is far from *AI scientist*. To build an AI agent that helps scientists generate hypothesis and make decision, I must understand how scientists deal with the problems themselves. Such methodologies, paradigms, and insights, are implicit knowledge of scientists. Hence, understanding and modeling how people use implicit knowledge should be the first step toward the AI scientist. On this basis, I decided to apply for graduate study in psychology and cognitive science. From my sophomore year, I start to explore the cognitive science literature and the philosophy of sciences literature. Thankfully, my thesis advisors showed great inclusion toward my *ridiculous* ideas and supported my work. I was happy to find that philosophers have gave the initial responses through the introspection from scientists, *i.e.*, Peirce's Abduction and Popper's Hypothetico-deduction (Peirce, 1955; Popper, 1959), which provide us with a good starting point to answer the questions in a computational way—as the significant progress in computational cognitive science (Lake et al., 2017), we are close to be able to model complex thinking patterns in real scenes. Computational models of scientific thinking patterns may lead to two potential merits: (1) proposing and predicting ideas given specific research context (*e.g.*, experiments, data, and literature); and (2) providing strong evidence at the large scale to current debates on the appropriateness of methodologies. Of course modeling scientific thinking patterns would never replace the insights generated by researchers—it is only generating proposals to broaden the limited bandwidth of researchers, and researchers refer to the proposals according to their values. This also disentangles researchers' personal bias from the entire development of the research projects, thus improve the reliability and reproducibility of science by transparentizing the decisions made by researchers. These experiences and ideas shape who I am today. **I would like to acknowledge my father and my thesis advisors with highest respect—without their mentorship with great inclusion and patience, I would never go to where I am today.**

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