RESEARCH STATEMENT

TIM CHEN, UNIVERSITY OF ADELAIDE, TIM.CHEN@ADELAIDE.EDU.AU

My research mission is to augment human capabilities by engineering human-centred AI systems. I pursue this mission by actively exploring emerging technologies to build novel interactive AI systems that empower and collaborate effectively with knowledge workers. This hands-on pursuit has led to my leadership roles in large interdisciplinary teams, including serving as the U of Adelaide research lead for the **Augmenting Ability CRC** bid (shortlisted for R25 Round 2) and as the human-AI interface lead for the Eureka Prize-winning, MRFF-funded **IMAGENDO project**. These shaped my exploration of human-AI interaction through three evolving paradigms: **AI as Assistant**, **AI as Collaborator**, and **AI as Oracle**.

AI AS ASSISTANT

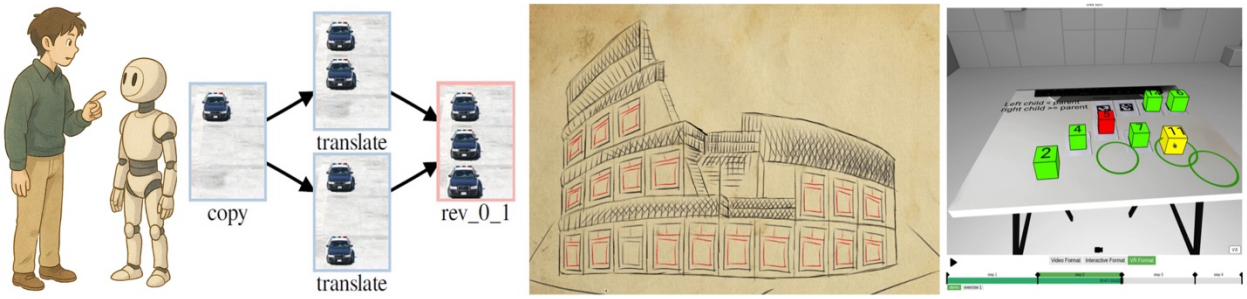

FIGURE 1. AI AS ASSISTANT. FROM LEFT TO RIGHT, AI MEMORISES REVISIONS [1], AI COMPLETES REPEATED SKETCHES [2], AI GENERATES DIFFERENT MODALITIES OF THE SAME TEACHING CONTENT [4].

In the 'AI as Assistant' paradigm, my research involves designing **AI systems to handle tasks that, while within human capability, are repetitive or tedious**. My research projects in content creation extensively leverages this model, allowing professionals such as artists and educators to offload laborious tasks to AI assistants. For instance, artists can delegate tasks to AI such as storing editing revisions [1][2], generating repeated sketch strokes [3] or creating different education content formats based on the same teaching video [4]. This automation enables professionals to dedicate more attention to higher-value tasks like creative ideation and concept development. My contributions in this area have resulted in practical innovations integrated into widely-used tools including GIMP and Autodesk's MeshMixer.

AI AS COLLABORATOR

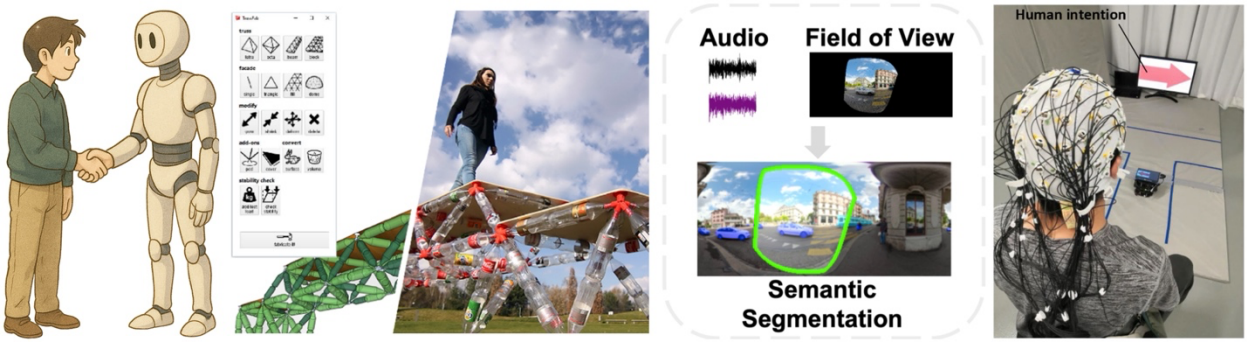

FIGURE 2. AI AS COLLABORATOR. FROM LEFT TO RIGHT, AI ASSISTS ON STRUCTURAL ANALYSIS [5], AI INFERS OUT-OF-VIEW OBJECTS [6], AND A BRAIN-COMPUTER INTERFACE SYSTEM FOR ROBOT CONTROL [10].

In the 'AI as Collaborator' paradigm, my research explores **AI systems that collaborate on tasks for which users may lack the requisite expertise or perceptual capabilities.** For instance, a user might design a shape but lack the expertise to assess its structural integrity [5] or a user's situational awareness might be limited by their field of view, whereas an ML model could infer potential hazards beyond the view [6]. To facilitate human-AI collaboration, my research has also explored the research theme of **expanding the communication bandwidth,** enabling AI to understand and adapt more effectively to human needs. My research has involved exploring a wide range of emerging technologies – such as neurophysiological signals and kinematic data to significantly augment the information flow. Key contributions include developing novel multi-modal biomarkers for continuous monitoring perceived presence [7][8] and stress levels [9] alongside a passive brain-computer interface enabling hands-free robot control [10] . These research works have been published on top venues such as CHI, ISMAR, VR, TVCG and AAAI.

AI AS ORACLE

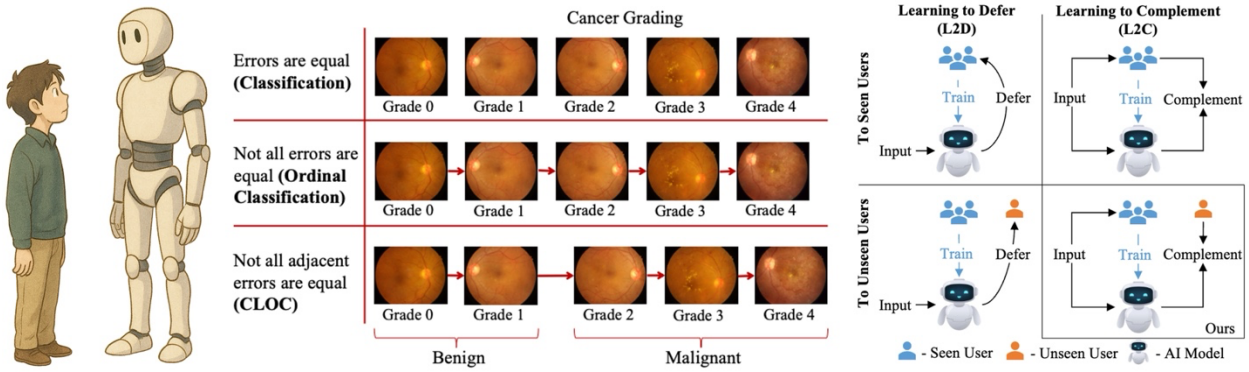

FIGURE 3. AI AS ORACLE. THE CLOC MODEL ALIGNS AI WITH CLINICIAN 'BIAS' AND THE L2CU PARADIGM CREATES A MODEL THAT LEARNS TO INTEGRATE BOTH HUMAN AND AI DECISIONS.

Finally, the 'AI as Oracle' paradigm conceptualizes **AI systems as possessing superhuman capabilities and an innate understanding of natural user interaction**, such as conversation or gestures. This leads me to assert that **ML models are becoming the new user interface**, a shift necessitating that HCI research transcend traditional interfaces to focus on engineering these ML models as adaptive systems that align with human intention and enrich natural human-AI interaction.

Within this paradigm, my work focuses on understanding nuanced human needs and translating them into the novel architecture and objective functions of ML models. A central aim is to develop methods for steering AI model behaviour, ensuring it aligns with and dynamically adapts to diverse levels of human expertise. For example, we developed a novel contrastive learning algorithm [11] to address clinicians' risk aversion, thereby mitigating overly cautious diagnostic patterns that arise from the fear of overlooking critical cases. Furthermore, we engineered a novel framework enabling AI to adapt to previously unseen users [12] and to learn from subjective assessments of ultrasound image quality from different clinicians [13]. Drawing on insights from health domain professionals, these works centre on translating critical clinical needs into robust AI architectures and adaptive model behaviours. Such contributions have resulted in multiple publications in leading conferences like CVPR and ISBI, and have attracted significant funding awards, including from MRFF, NHMRC IDEA and the AEA Ignite.

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