Computational Gaze Analysis for Social Competence Assessment in Conversation Listening : Indicator Mining, System Design, and Technical Verification

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Abstract (should be within 1st page)

Social competence plays a vital role in human interaction, yet its objective assessment remains a significant challenge in both clinical and technological domains. While clinical evaluations traditionally rely on subjective scales, the listening dimension is a critical component of social interaction that remains poorly characterized by objective and real-time behavioral metrics. To bridge this gap, this research establishes a computational framework to analyze intricate gaze and head movement patterns during social listening. By designing a high-ecological-validity three-person interaction environment and utilizing Microsoft HoloLens 2 for immersive data collection, a multi-dimensional analysis of gaze dynamics was performed. This phase identified three robust indicators, including the frequency of social nodding as a non-verbal backchannel, the strategic allocation of selective attention toward speaker-related regions of interest versus peripheral areas, and the stability of vertical gaze dispersion as a measure of attentional focus. These computational features correlate significantly with social competence scores rated by clinical experts, suggesting their potential as objective digital biomarkers. Building upon these empirical findings, the study explores the engineering feasibility of transitioning these behavioral indicators into a functional assistive prototype. A technical scheme was designed to bridge the gap between offline behavioral identification and online interactive feedback. To ensure technical reliability, the core feature extraction algorithms were validated against the clinically-annotated ground truth established in the previous phase. The results demonstrate the technical feasibility of the system and provide a verified architectural foundation for future personalized social skill training tools. Ultimately, this work contributes to both the cognitive understanding of social interactions and the technical development of gaze-based empathic computing technologies.