

論文内容の要旨

博士論文題目

Automated social skills training system based on multimodal analysis of neurodevelopmental and psychiatric disorders

神経発達症と神経疾患のマルチモーダル分析に基づくソーシャルスキルトレーニングシステム

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(論文内容の要旨)

This research proposed an automatic evaluation-feedback method based on data driven analyses of newly collected multimodal interaction datasets, including people with psychiatric/developmental disabilities. The BERT-based sequential similarities have been proposed to capture idiosyncratic meaning shifts in spoken language. By analyzing monologue speech with autistic trait labels, the result highlighted the importance of BERT-based sequential similarities for severity assessment in autism spectrum disorder. The research extends to human-human SST data with schizophrenic labels, revealing atypical vocal formants in individuals with schizophrenia. The investigation further explores formal thought disorder (FTD) characteristics, linking schizophrenia and

autism spectrum disorder at the symptomatic level. The analyses revealed that longer-duration speech tasks about negative memories elicit increased FTD symptoms, which helps develop personalized SST feedback. With the enhanced multimodal features derived from these analyses, training regression models for skill-specific subjective scores have been completed and integrated with a rule-based feedback generator. Two types of the SST system are developed, with the second incorporating an adaptive behavior generation model. Perception studies confirm well-synchronized, human-like behaviors, showcasing the feasibility of an automated SST system. At the end of the dissertation, I discussed the future directions of this research by comparing SST sessions by human trainers and computerized systems.

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(論文審査結果の要旨)

This thesis introduces an automatic social skills training method using newly collected multimodal interaction datasets. This research proposes using BERT-based sequential similarities to capture shifts in spoken language meaning. By analyzing monologue speech with autistic trait labels, he emphasizes the importance of BERT-based sequential similarities for autistic severity assessment. Additionally, this research examines human-human interaction data during social skills training and explores formal thought disorder (FTD) characteristics. It finds that longer-duration speech tasks about negative memories increase FTD symptoms.

In summary, he proposed a new method for measuring the similarity of speech flow based on BERT sequential similarities. It is a novel computational approach to capture the consistency of speech, mainly used for people with ASD and schizophrenia. Finally, the candidate successfully constructed a system called automated social skills training, in which his BERT-based sequential similarities is integrated. Several feasibility and user studies were conducted to evaluate the proposed system. His system is now placed at a hospital in the Nara area. His contribution to the system development and mental health field is remarkable. His active contribution to multidisciplinary and international collaboration also helped to complete this thesis.

A series of his research resulted in two high-quality peer-reviewed international and domestic English journal papers and five peer-reviewed international conference papers for two years of his doctoral course. As a result, the thesis is sufficiently qualified as a doctoral thesis in engineering.