THEME-BASED RESEARCH SCHEME
PUBLIC SYMPOSIUM 2024
主題研究計劃研討會

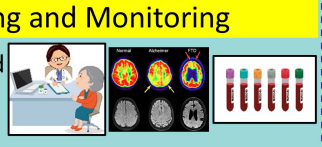
Research and Development of Artificial Intelligence in Extraction and Identification of Spoken Language Biomarkers for Screening and Monitoring of Neurocognitive Disorders

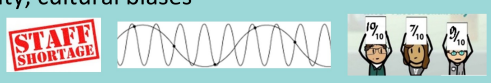
Neurocognitive Disorder (NCD): A Global Challenge

- Aging global population leads to higher NCD rates
- Severe disease burden highlights need for early detection

Goal: AI-enabled Spoken Language Technologies to Transform NCD Screening and Monitoring

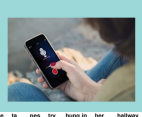
- Existing screening methods limited by staff shortage, undersampling, invasiveness, cost, accessibility, subjectivity, cultural biases

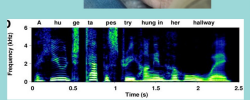




AI-driven speech analytics for NCD screening

- Speech reflects cognition, culturally sensitive, easy to capture
- Enables big data analyses for objective assessment, automation for scalable and affordable screening

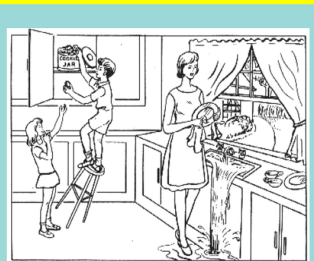




Design and collect older adult speech corpus and other related data, e.g. brain scans	→	AI-enabled, automated analyses - Identify speaker - Recognize spoken content - Devise machine learning models with robustness	→	AI-enabled, biomarker ID - Acoustic features - Linguistic features - NCD screening algorithms

Initial Benchmarks

- Cookie Theft Description Task
- Data from the ADReSS Challenge (DementiaBank Pitt Corpus)
- Dialogs between investigator and 292 participants, including healthy and NCD individuals
- TF-IDF and BERT features derived from manual (WER=0%) versus ASR (WER 33.2%) transcripts
- ASR for auto NCD detection competitive at 88% accuracy



DEVELOPMENT OF THE CUHK ELDERLY SPEECH RECOGNITION SYSTEM FOR NEUROCOGNITIVE DISORDER DETECTION USING THE DEMENTIABANK CORPUS

Zi Ye, Shoukang Hu, Jinchao Li, Xurong Xie, Mengzhe Geng, Jianwei Yu, Junhao Xu, Boyang Xue, Shansong Liu, Xunying Liu, Helen Meng

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A COMPARATIVE STUDY OF ACOUSTIC AND LINGUISTIC FEATURES CLASSIFICATION FOR ALZHEIMER'S DISEASE DETECTION

Jinchao Li[1], Jianwei Yu[1], Zi Ye[1], Simon Wong[1], Manwai Mak[2], Brian Mak[3], Xunying Liu[1], Helen Meng[1]

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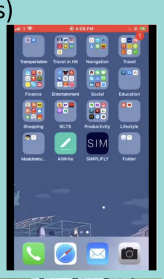
2 publications in IEEE ICASSP 2021

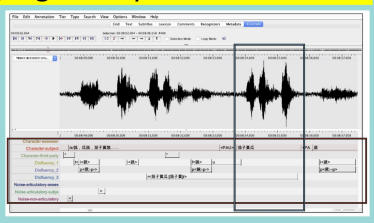
Corpus Design, Collection and Transcription

- The **C**hinese **U**niversity of Hong Kong – Cognitive Assessment Using **M**achine Le**A**rning Empowe**R**ed Voic**E** Ana**L**ysis
- 13 cognitive tasks/tests
- Baseline visit plus 2 follow-ups (incl. smart apps)
- Personalized, longitudinal cognitive health data
- Largest elderly speech dataset for Hong Kong



Fully Automatic Pipeline for NCD Screening using Spoken Language Analytics

- First multilingual (Cantonese included) automatic system for NCD screening
- Tailored to Hong Kong's context and culture
- Explainable spoken language biomarkers



Integrated and Enhanced Pipeline System to Support Spoken Language Analytics for Screening Neurocognitive Disorders

Helen Meng[1,2,3], Brian Mak[4], Man-Wai Mak[5], Helene Fung[6], Xianmin Gong[2,6], Timothy Kwok[7,8,9], Xunying Liu[1], Vincent Mok[10,11,12,13], Patrick Wong[14,15], Jean Woo[7,9], Xixin Wu[2], Ka Ho Wong[1], Sean Shensheng Xu[5,16], Naijun Zheng[1], Ranzo Huang[4], Jiawen Kang[1], Xiaoquan Ke[5], Junan Li[3], Jinchao Li[1], Yi Wang[1]

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Devising a Set of Compact and Explainable Spoken Language Feature for Screening Alzheimer's Disease

Junan Li[1], Yunxiang Li[1], Yuren Wang[2], Xixin Wu[1], Helen Meng[1]

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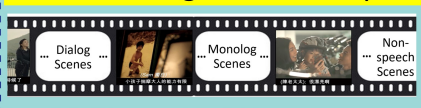
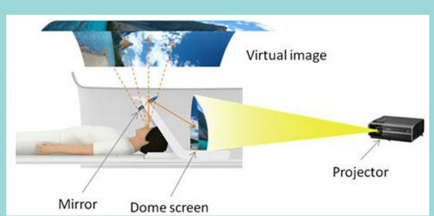
Connecting Brain Activity with Spoken Language





- Created movie-watching task linking spoken language with brain activity, captured through neuroimaging to detect and predict NCD with competitive performance
- Awarded Geneva Inventions 2024 Silver Medal

Pilot Trials

- Integrated technologies in age-friendly, smart health apps
- Piloting trials in the community
- Enhance early NCD detection and personalized health insights

Interdisciplinary Team

- Interdisciplinary Project Team in AI, Geriatrics and Gerontology, Linguistics, Medicine, Neurology, Neuroscience, Nursing, Public Health, Psychology.
- Investigators (front row, left to right): Profs Xianmin Gong , Xixin Wu , Thomas Lam, Bonnie Lam, Brian Mak (HKUST), Manwai Mak (PolyU), Helen Meng , Vincent Mok , Helene Fung , Timothy Kwok , Diana Lee, Xiaojuan Ma (HKUST)
- Absent from photo: Profs Kelvin Tsoi , Andrew Liu, Patrick Wong, Jean Woo