

## Education

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- ◆ 2019.09-2023.06 **Beijing Normal University-Hong Kong Baptist University International College**
  - Bachelor of Science in **Statistics**
  - GPA: 3.51/4.0(top 15%), **First Class** Honours Degree certificate from Hong Kong Baptist University
  - **IELTS 7.0** (Listening 7.5, Speaking 6.5, Writing 6.5, Reading 6.5)
- ◆ 2023.09-2024.08 **University College London**
  - Master of Science in **Health Data Science**
  - **Academic representative** of Department of Health Population Science
  - Dissertation Topic: **AI-enabled Healthcare Systems** particularly on **Natural Language Processing** (expected)

## Current Job

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- ◆ 2023.07-2024.06 **City University of Hong Kong**
  - Part-time **Research Assistant**
  - Department of Infectious Diseases and Public Health

# Research Fields

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## ***For Artificial Intelligence and Machine Learning for Healthcare:***

- Foundation course(completed or in progress):
  - *Data Mining, Advanced Machine Learning for Healthcare, Artificial Intelligence for Healthcare*
- Publications:
  - *Application of machine learning to predict mental health disorders and interpret feature importance*  
Yifan LI, published by **IEEE ISCTIS 2023**

## ***For Epidemiology and Biostatistics:***

- Foundation course(completed or in progress):
  - *Programming with Python for Health Research, Advanced Statistics for Records Research, Regression Modelling, Advanced Statistics, Survival Analysis, Time Series Analysis, Categorical Data Analysis*
- Publications:
  - *Status and Determinants of Breakfast Eating Behavior among Chinese Residents: A National Cross-Sectional Study*  
Ming LIU, Yifan LI, Shujie DONG, ready to submit by **SCI(Q1)**

## ***For Health Economics and Financial Statistics:***

- Foundation course(completed or in progress):
  - *Principle of Microeconomics, Simulation, Optimization, Logistic, Cost Effectiveness Modelling for Health Technology Assessment*
- Publications:
  - *Empirical analysis of constructing GARCH model to predict stock price with trading volume*  
Yifan LI, published by **CPCI ICFIED 2023**
- Research projects:
  - *Empirical analysis of the spillover effect of trading volume and amount on stock prices - based on VAR (DCC)-BEKK- EGARCH models*

# **Antidepressant Therapy Response Prediction via Multimodal Fusion Model**

## Background

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### Depression:

- 61% of Hong Kong adults currently suffer from poor mental well-being, with 1 in every 7 people developing a common mental disorder in their lifetime [1].
- The number of mental health hospitalizations more than doubled from 2016 to 2022[2].

### Differences in medication individualization:

- efficacy of response to antidepressants may vary significantly for different individuals
- variability influenced by a variety of factors

### Trial-and-error proposition:

- difficult to identify the most effective treatment
- each inadequate trial can incur prolonged morbidity, disability and exposure to adverse effects
- substantial healthcare costs

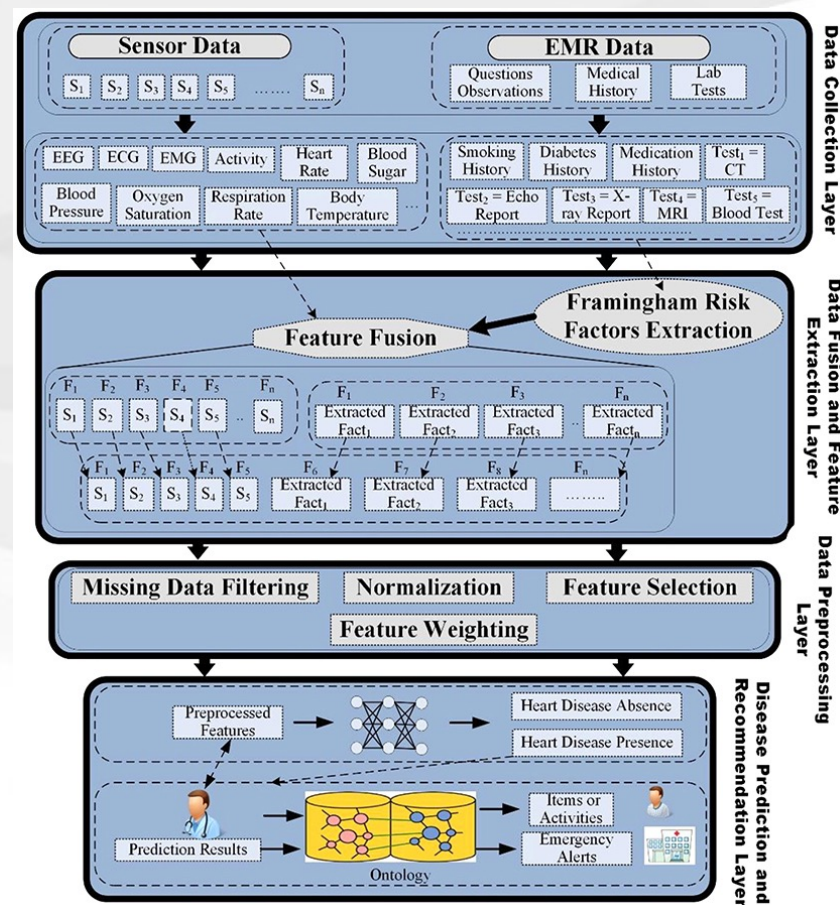
## Objective

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- to develop a **machine-learning predictive model** based on electronic health records for predicting an individual's response to various types of antidepressant medications in Hong Kong.
- to predict which class of medication would work better for a particular patient and **compare the responses** of different types of antidepressants for individuals.
- to predict whether **medication combination** would work better for a particular patient compared with the **single medication**.
- to identify and assess the importance of **the key influential characteristics**, including clinical, demographic, and genetic factors, for predicting response to antidepressants.
- to interpret the model and understand the contribution of different features via **model Interpretation** like feature significance analysis and SHAP values.

## Methodology: Multimodal Fusion Model

- **Multimodal fusion model:** a process in which multiple layers of data processing, aggregation and prediction modeling[3].
- **Antidepressant category:** Bupropion, Mirtazapine, SNRI, SSRI
- **Feature indicators:** Demographics, Medical history, lifestyle, genetic profile, physiological parameters.
- **Machine learning prediction models:** Random forest, GLM, SVM, Logistic regression, LSTM, Gradient boosting, DNN.



## **Methodology:** Use Open source data to complete prototype validation

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Open source data:

- [DAIC-WOZ](#) dataset and E-DAIC(Extended-DAIC): Video, audio and text modes
- Lanzhou University depression dataset: EEG and audio modes
- Multimodal Twitter dataset: Pictures and text modes
- Weibo user depression data set: Pictures and text modes

## Result: Baseline Characteristic Table

Patient characteristics overall and by antidepressant classes(example)

Class of antidepressant prescribed	Any	Bupropion	Mirtazapine	SNRI	SSRI
<b>Demographics</b>					
<i>Gender</i>	No.(%)	No. (%)	No. (%)	No. (%)	No. (%)
Male	5974 (34.03)	689 (39.04)	405 (46.34)	491 (30.03)	4389 (33.04)
Female	11582 (65.97)	1076 (60.96)	469 (53.66)	1144 (69.97)	8893 (66.96)
<i>Marital Status</i>					
Married					
Single					
Widowed					
Separated/Divorced					
<b>Medical history</b>					
<b>Genetic profile</b>					
<b>Lifestyle</b>					
<b>physiological parameters</b>					
	.				
	.				
	.				



## Result: Baseline Characteristic Table

Patient characteristics overall and by antidepressant combination(example)

Class of antidepressant prescribed	B+ M	B+SNRI	M+SNRI	B+SSRI	M+SSRI	SNRI+SSRI
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### Demographics

#### *Gender*

Male

Female

#### *Marital Status*

Married

Single

Widowed

Separated/Divorced

### Medical history

#### Genetic profile

#### Lifestyle

#### physiological parameters

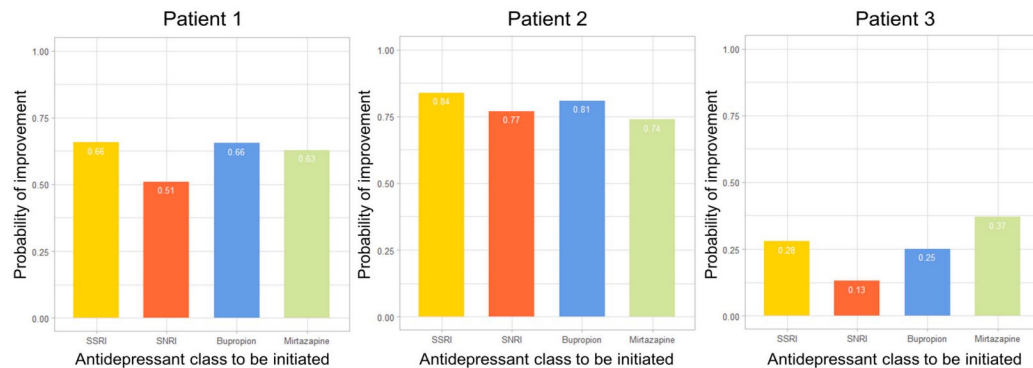
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## Result: Prediction Models Comparison

## Model comparison table (example)

[illegible]

## Individual Antidepressants Comparison[4]

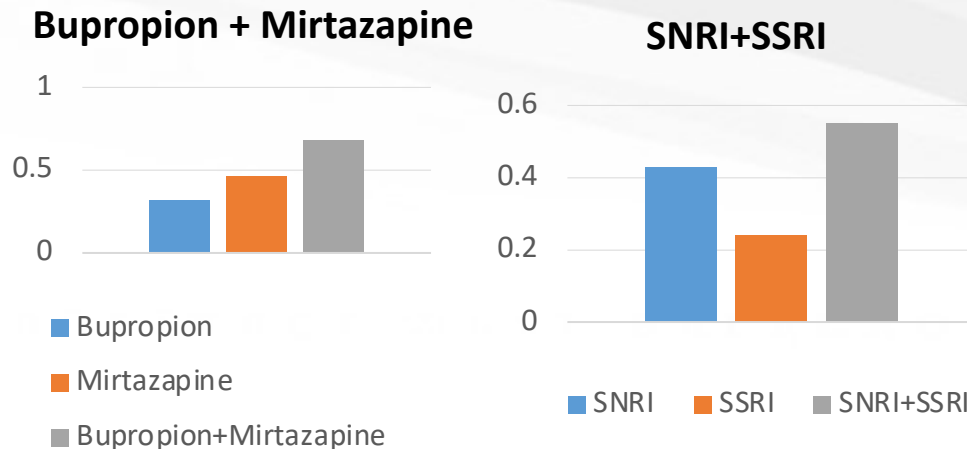


Moderate likely

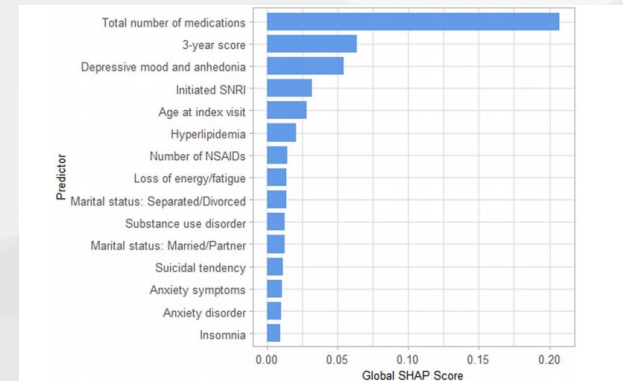
High likely

Low likely

## Antidepressants Combination Comparison



## Factor analysis: SHAP score



## Model Interpretation: SHAP plot



Combination therapy is *more effective* than the single therapy

# Motivation and Career Plan

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## WHY PHD?

- Make contribution in the field of research and realize my own value
- Good at thinking and learning, perseverance and ambition
- Career development requirement

## WHY THIS FIELD?

- Aspire to be a doctor from an early age because of the family atmosphere
- HTA could improve allocation and efficiency of healthcare resources
- AI has great potential in healthcare to improve human life quality

## WHY THIS RESEARCH GROUP?

- The research fields are consistent and suitable
- One of the few groups that do both health economics and statistics
- Interested in pharmacy and likely to work in pharmaceutical companies in the future

## CAREER PLAN?

- Obtain PhD in 3-4 years
- Obtain Hong Kong permanent residence
- Work and settle in Pearl River Delta : Clinical data analysis/Biostatistics /AI algorithm in hospital research institution/Pharmaceutical foreign companies

## Reference

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- [1] Kwok JOT, Yan RWK, Kwok CPC, Cheng GWH, Lin C, Wong BHC, Cheng ST, Lee ATC and Lam LCW (2022) Common mental disorders during the COVID-19 pandemic in Hong Kong: Age-related differences and implications for dementia risk. *Front. Psychiatry* 13:909162. doi: 10.3389/fpsyt.2022.909162
- [2] Clisu, D. A., Layther, I., Dover, D., Viner, R. M., Read, T., Cheesman, D., Hodges, S., & Hudson, L. D. (2022). Alternatives to mental health admissions for children and adolescents experiencing mental health crises: A systematic review of the literature. *Clinical child psychology and psychiatry*, 27(1), 35–60.  
<https://doi.org/10.1177/13591045211044743>
- [3] Ali F, El-Sappagh S, Islam SM, Kwak D, Ali A, Imran M, et al. smart healthcare monitoring system for heart disease prediction based on ensemble deep learning and feature fusion. *Information Fusion*. (2020) 63:208–22. doi: 10.1016/j.inffus.2020.06.008
- [4] Sheu et al. "AI-assisted prediction of differential response to antidepressant classes using electronic health records" *NPJ Digital Medicine*, 2023 6(1): 73.