Yunpu Zeng

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Educational Background

Georgia Institute of Technology (Georgia Tech) Ph.D in Industrial Engineering,

Georgia Institute of Technology (Georgia Tech) Master of Science in Industrial Engineering,

Sichuan University (SCU) Bachelor of Science in Industrial Engineering,

Work in Progress

o Kunpeng Wang, Yunpu Zeng, Zhichun Ye, Zheng Yang, Sai Cheong Fok. "Intra-subject Respiratory Motion Modeling Based on 4D CT Images via Diffeomorphic Approach" [J]. Accepted at the Future of Information and Communication Conference (FICC) 2025.

Research Experience

Natural History State-Transition Markov Model for Alcohol Liver Disease Research Assistant, Supervised by Asst.Prof.Jovan Julien (Georgia Tech)

 This project focus on developing a comprehensive state-transition Markov model that simulates the progression of alcoholrelated liver disease (ALD) in the U.S. population, incorporating individual-level health states and varying drinking behaviors. The model will predict long-term trends in ALD prevalence and mortality while assessing the impact of specific public health interventions, such as Mindfulness-Based Relapse Prevention (MBRP), on reducing harmful drinking behaviors and improving disease outcomes.

Forecasting Flu Hospitalizations with Google Search Trends Using a Compartmental Model Atlanta, GA 01/2024 - Present Research Member, Supervised by Asst. Prof. Shihao Yang (Georgia Tech)

- This project, in cooperation with Northeastern University, focuses on probabilistic forecasting of flu hospitalizations using Google search trends. By sampling predictions within the model structure, various methods such as naive strategies, compartmental models, machine learning, statistical time series, temporal deep learning, and advanced multivariable temporal models are employed to enhance prediction accuracy and timeliness.
- O Demonstrated a compartmental SIRS model combined with an Extended Kalman Filter (EKF) to accurately predict seasonal flu hospitalizations, leveraging the EKF for state estimation and noise reduction in real-time data assimilation.
- Generated revised rates of corrected data for the CDC (Centers for Disease Control and Prevention), ensuring accuracy and reliability in reported flu hospitalization statistics and facilitating better public health responses.

Cost-Effectiveness of Lactulose and Virtual Tai-Chi for Fall Prevention in Cirrhosis Patients Atlanta, GA Project Leader, Supervised by Asst. Prof. Gian-Gabriel Garcia and Jovan Julien (Georgia Tech) 01/2024 - 05/2024

- This project was conducted in cooperation with the University of Michigan's Michigan Cirrhosis Program. Developed a cost-effectiveness model incorporating the natural history of hepatic encephalopathy, along with the therapeutic effectiveness of sequential lactulose treatment and Virtual Tai-Chi interventions. This model integrates clinical progression data and treatment efficacy to assess long-term health outcomes.
- Derived a microsimulation model to simulate the health transitions of one hundred thousand patients through five stages of cirrhosis. This model tracks the incidence of falls among cirrhosis patients, providing a detailed analysis of disease progression and the impact of interventions.
- Obtained a cost-effectiveness analysis scenario by evaluating the impact of treatment costs and utility values, assessing the overall economic efficiency of sequential lactulose and Virtual Tai-Chi in preventing falls among patients with cirrhosis.

Intra-Subject Respiratory Motion Modeling Using a Diffeomorphic Approach Chengdu, China 03/2022 - 08/2023

Project Leader, Supervised by Asst. Prof. Kunpeng Wang and Prof. Sai Cheong Fok (SCU)

- o I constructed a novel paradigm for deriving human lung motions using affine transformations, enhancing the precision of respiratory motion understanding, facilitating the lung biopsy surgery.
- To optimize lung motion predictions, I employed both linear and non-linear least squares methods to fit the correspondence model. DVFs are developed to characterize respiratory motion, using point cloud data extracted from 4D CT images and manually identified landmarks with semi-automatic tools to reduce errors and improve model reliability.

Atlanta, GA 01/2025 - now

Atlanta, GA 08/2023 - 12/2024

Chengdu, China 09/2019 - 06/2023

Atlanta, GA

07/2024 - Present

1/2

 I acquired ground truth deformable vector fields (DVFs) for subjects to enable supervised image registration and ensure accurate motion modeling.

Airway Tree Segmentation Using U^2 -net and Dice Loss Function

Key Project Member, Supervised by Asst. Prof. Kunpeng Wang (SCU)

- The Airway Tree Modeling Challenge organized by MICCAI focuses on the crucial task of airway tree segmentation in CT scans. We normalized voxel values to enhance computational efficiency during network training.
- Our training process employed the U²-net architecture, featuring a two-level nested U-structure for airway tree segmentation. The U²-net was trained end-to-end using the Dice loss function defined as the weighted sum of the side and final output saliency probability maps.
- To refine the segmented results, we removed distinguishable large non-airway regions by assigning different labels to separate regions and extracting the airway regions. We then implemented segmentation visualization using 3D Slicer and ITK-SNAP for detailed and accurate analysis.

A Variational Level Set Method for Lung Field Segmentation

Research Assistant, Supervised by Asst. Prof. Kunpeng Wang (SCU)

- Implemented a Variational Level Set method to maintain the level set function as a signed distance function, governed by the *p*-Laplace equation. And then employed this Variational Level Set method in conjunction with R and MATLAB to segment 2D CT images of the lungs accurately.
- Optimized segmentation outcomes by adjusting algorithm parameters and refining code implementations, integrating Shannon entropy with a region-based variable exponent p-Laplace equation model to enhance accuracy and robustness against noise and artifacts.

Invention Patent

"A Novel Paradigm for Modeling Human Lung Motion and Its Corresponding Biopsy Device", Under Review.

Teaching Experience

- Teaching Assistant, "Analytic Geometry and Calculus I", Sichuan University, 02/2023-06/2023.
- Teaching Assistant, "Analytic Geometry and Calculus III", Sichuan University, 09/2022-01/2023.
- Teaching Assistant, "Physics II", Sichuan University, 09/2021-01/2022.
- The Writing Center's Consultant, Sichuan University, 09/2021-01/2022.

Leadership Experience

President of the Student Council, Youth League Committee of the College, 09/2021-06/2022.

Honors and Awards

- Outstanding Capstone Project, 2023.
- Outstanding Graduating Student, 2023.
- National Scholarship, 2022.
- National Scholarship, 2021.
- Outstanding Student Leader, 2021.
- First Prize, National Undergraduate Engineering Training Integration Ability Competition, 2020.

Skills and Interests

Languages: Fluent in English; Native in Mandarin.

IT Skills: Proficient in R, Matlab, Python, SIMUL8, SQL, Tableau, ITK-SNAP, Slicer. **Interests:** Piano, Painting, Singing, Latin Dance.

Chengdu, China

05/2022 - 08/2022

Chengdu, China 09/2021 – 01/2022