Kuan-I (Gary) Chung

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Research Interests

Keywords: computer vision, medical imaging, AI/ML, visualization, statistics

Education

- **Ph.D. Vanderbilt University** — Nashville, TN
  Department of Computer Science — Aug. 2023 - Present
- **M.S. National Sun Yat-sen University** — Kaohsiung, Taiwan
  Department of Applied Mathematics; GPA: 3.96/4.3 — Sep. 2016 - Jul. 2018
  - **Thesis**: Dimension Reduction by NNMF: Application in Screws' Forging Force Signal Classification
  - **Award**: Rising Statistician Scholarship (top two among 15 students)
- **B.S. National Sun Yat-sen University** — Kaohsiung, Taiwan
  Department of Applied Mathematics; GPA: 3.31/4.3 — Sep. 2012 - Jun. 2016
  - **Independent Research**: A study of the relationship between larceny rate and larceny detection rate with data mining
  - **Honor**: Undergraduate Independent Research Fellowship

Research Experience

- **Visiting Researcher, Massachusetts Institute of Technology** — Cambridge, MA
  CSAIL, EECS; Supervisors: **Prof. John Guttag** and **Prof. Adrian Dalca** — Mar. 2022 - Feb. 2023
  - **Elastic Deformable Test-time Augmentation on One-shot Medical Image Segmentation**:
    - Leveraged diffeomorphic deformation which is smooth and invertable as a augmentation strategy.
    - Outperformed the traditional affine transformation by up to 0.05 Dice score.
    - Introduced **improvement map** to visualize difference between before and after using our strategy.
- **Research Assistant, National Sun Yat-sen University** — Kaohsiung, Taiwan
  MDSRC; Supervisors: **Prof. Mong-Na Huang**, **Prof. Mei-Hui Guo** and **Prof. Chieh-Sen Huang** — Sep. 2016 - Jul. 2018
  - **Screws' Forging Force Signal Analysis**:
    - Reduced dimension of signal from a 386-dimensional data to four-bases data.
    - Applied DBSCAN to clustered samples based on dimension-reduced data.
    - Developed a method to detect shifting in production line.
  - **Public transit analysis — A Pilot Study**: to analyze public transit usages.
    - Leveraged masses' riding record, transits' routes, and GIS data and then visualized public transit usages on maps.
    - Helped local government understand public's need and plan for new transit services.
    - A one-year funded project granted from local government.
  - **TFT-LCD panel defect factor analysis**: Searched degrading machines based on manufacturing records.
    - Appied LASSO regression model as well as statistical analysis to find the degrading machines.
    - Our prediction covered the real/potential degrading machines, save technicians' time from 8 hours to 5 seconds.
- **Undergraduate Independent Research, National Sun Yat-sen University** — Kaohsiung, Taiwan
  Office of Research and Development; Supervisor: **Prof. Mong-Na L. Huang** — Jul. 2015 - May. 2016
  - **A study of the relationship between larceny rate and larceny detection rate with data mining**:
    - Applied non-parametric hypothesis testing to analyze if crime rate had seasonal trends.
    - Applied clustering analysis and visualization to group the similar division of Taipei Police Department.

Industry Experience

- **Data Scientist, Wistron Corporation** — Kaohsiung, Taiwan
  Software Development Department VI, Digital Technology — Sep. 2018 - Present
  - **Clothes Virtual Try-on**: Implement SOTA GAN models to fulfill virtual try-on in real practice.
  - **MIT CSAIL Alliance Program**: Bridging partnership between MIT and Wistron
  - **Manufacture scheduling optimization**:
    - Fully understood the complicated business knowledge in two weeks before this one-year project closed.
    - Tackled unsolved problems: (1) balanced machines' loading (2) reduced algorithm's running time from 4 hr to 10 sec.
    - Reduced scheduling time from 8 hours by human to 10 seconds by algorithm.
    - Introduced design pattern to development team, enhance codes' flexibility.
  - **EIC syndrome (breast cancer) classification**: Use mammogram to predict if a patient has EIC syndrome.

- Reached 0.84 AUROC which a physician could not achieve.
- Collaborated with radiologists and exchanged our domain knowledge.
- Built a AI model training platform (using Django), allowing domain users to train classification model without coding.
- Patent under review

◦ **Parts ensemble recommendation system**: Applied association rule to avoid material combination with high defect rate.
- Reduced manufacturing costs (10 million NTD/month) by proper disposal of material waste.
- Practiced agile software development

◦ **Data augmentation with deformation**: Applied Brain Registration model to augment manufacturing AOI data.
- Augmented 100x images of defect products
- Patent obtained (United States and Taiwan)

• **Data Science Intern, Metals Industry Research and Development Center** — Kaohsiung, Taiwan
Industrial Upgrading Service Department; DIGI+ Program in Industrial Development Bureau — Sep. 2017 - Dec. 2017

• **Data Science Intern, AU Optronics** — Taichung, Taiwan
Head Quarter Summer Intership Program — Jul. 2017 - Aug. 2017

Publication and Patent

- **K. Chung**, G. Chian, A. Dalca, and J. Guttag., "Elastic Deformable Test-time Augmentation on One-shot Medical Image Segmentation" in preparation, 2022.
- Z. Lin, C. Chien, and **K. Chung**, "Training data increment method, electronic apparatus and computer-readable medium", US Patent No.11348349, United States, 2022 (Taiwan Patent I743837, 2021).
- **K. Chung**."Dimension Reduction by Non-Negative Matrix Factorization: with Application in Screws' Forging Force Signal Classification", Master Thesis, National Sun Yat-sen University, Taiwan, 2018.
- **K. Chung**."A study of the relationship between larceny rate and larceny detection rate with data mining", Undergraduate Research, National Sun Yat-sen University, Taiwan, 2016.

Presentations

• **Dimension Reduction by NNMF: Application in Screws' Forging Force Signal Classification** — Taiwan
The 27^{th} South Taiwan Statistics Conference and 2018 Chinese Institute of Probability and Statistics Annual Meeting — Jun. 2018

• **Dimension Reduction by NNMF: Application in Screws' Forging Force Signal Classification** — Taiwan
NSYSU and NUK Statistics Day: Keynote of Rising Statistician Scholarship Awardee — Apr. 2018

• **R Language Workshop: Application in Geographic Visualization** — Taipei, Taiwan
Graduate Institute of Environmental Engineering, National Taiwan University — Mar. 2018

Teaching Experience and Tutorship

• **Internal Training Lecturer, Wistron Corporation** — Taiwan and China
Introduction of Python in Data Science, an 18-hour online course — Oct. 2019

• **Teacher Assistant, National Sun Yat-sen University** — Kaohsiung, Taiwan
Department of Applied Mathematics; Department of Chemistry — Sep. 2016 - Jun. 2018
- **MATH204**: Differential Equations I; **MATH302**: Complex Analysis I; **CHEM105/CHEM106**: Calculus I/II
- Mathematics Advanced Placement Program for Excellent K-12 Students

• **Tutor of High School Mathematics** — Kaohsiung and Tainan, Taiwan
five classes in cram schools and ten individual students — Sep. 2012 - Jun. 2018

Leadership

• **Organizer of Thursday Night Off-work Study Group** — Kaohsiung, Taiwan
Topics: AI/ML, data science, data engineering, software engineering — Mar. 2021 - Jun. 2021

• **Organizer of Monday Night English Study Group** — Kaohsiung, Taiwan
Focused on English Writing as well as some TOEFL preparation — May. 2020 - Aug. 2021

• **Organizer of Student Volunteers, IMAGINARY – an exhibition of Mathematics** — Kaohsiung, Taiwan
Mathematisches Forschungsinstitut Oberwolfach — Dec. 2015 - Feb 2016

• **Vice President of Schweitzer Program, Ministry of Education** — Kaohsiung, Taiwan
Organized and taught in Summer school for remote-area ninth-grade students — Jul. 2015 - Aug. 2015

Honors and Scholarship

- **Rising Statistician Scholarship** — Kaohsiung, Taiwan
  Department of Applied Mathematics, National Sun Yat-sen University — Apr. 2018
- **Honorable Mention of Final Presentation** — Taipei, Taiwan
  DIGI+ Program in Industrial Development Bureau, Ministry of Economic Affair — Dec. 2017
- **Undergraduate Independent Research Fellowship** — Kaohsiung, Taiwan
  National Sun Yat-sen University — Jul. 2015 - May. 2016
- **Calculus World Cup — Top 12 Teams (700 teams, 300 colleges from 45 countries)** — Taipei, Taiwan
  National Taiwan University and BoniO Inc. — Feb. 2016

Skills Summary

- **Languages**: **Python**(Pandas, NumPy, matplotlib, TensorFlow2, Django), **HTML/JS/CSS**(Bootstrap, Plotly), **SQL**, **R**
- **Tools**: Linux, Docker, git, LaTeX, agile software development