

# Le Duc Khai

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Permanent Resident in Canada

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## Research Interest

My current research spans all aspects of semi-supervised learning (speech/text/vision/time-series), in which I have been bringing research to real-world business scenarios. To provide cheap medical care for the poor, I am interested in developing machine learning algorithms that serve medical purposes, e.g. in medical imaging, bio-signals, tele-medicine, natural language processing, and so on.

## Education

### University of Toronto

*Master of Applied Science in Biomedical Engineering*

Toronto, Canada

*January 2024 – Present*

- The university was ranked 1st in Canada, 12th in the world in Computer Science, and 15th in Medicine (QS Rankings)
- Research area: Machine Learning for Multivariate Time-series
- Supervisor: **Prof. Shehroz Khan** (h-index 26)

### RWTH Aachen University

*Bachelor Thesis in Computer Science*

Aachen, Germany

*December 2022*

- The university was ranked 2nd in Germany and 50th in the world in Computer Science (THE Rankings)
- Thesis supervisor: **Prof. Hermann Ney** (h-index 113), **Prof. Ralf Schlüter** (h-index 50)
- Thesis title: Unsupervised Pre-Training for Vietnamese Automatic Speech Recognition in the HYKIST Project [DOI]
- Thesis grade: 1.0/6.0 (German grade), 100/100 (International percentage)

### FH Aachen University of Applied Sciences

*Bachelor in Biomedical Engineering, taught-in-German program*

Jülich, Germany

*December 2022*

- The university was ranked 1st among Universities of Applied Sciences in Germany in Engineering and Informatics (WiWo Ranking)
- Thesis supervisor: **Prof. Ilya Digel** (h-index 23)
- Overall grade: 2.2/6.0 (German grade), 80/100 (International percentage)

### Vietnam National University Ho Chi Minh City

*Bachelor in International Economic Relations*

Ho Chi Minh City, Vietnam

*October 2016*

- The university was ranked 1st overall in Vietnam and 701-750th in the world (QS Rankings)
- Top 100 out of 354897 candidates (0.02%) with total scores of 27/30 in the Vietnamese National High School Graduation Examination 2015 in Mathematics, Physics and English
- Grade: 1st ranked - Valedictorian

## Research Experience

### University Health Network

*Graduate Research Assistant*

Toronto, Canada

*January 2024 – Present*

- University Health Network is ranked as the world's 5th best hospital (Newsweek 2023) and ranked 1st in rehabilitation.
- Research project: Predicting Agitation in People Living with Dementia

### Machine Learning and Human Language Technology Group, RWTH Aachen University

*Student Research Assistant*

Aachen, Germany

*May 2021 – Present*

- Research supervisor: **Prof. Hermann Ney** (h-index 113, 63000+ citations, the most cited researcher and the highest h-index in the world in Speech Recognition and in Machine Translation)
- Research co-supervisor: **Prof. Ralf Schlüter** (h-index 50, 12000+ citations)
- Research topics: Semi-Supervised Learning for Medical Speech Recognition

### FH Aachen University of Applied Sciences

*Research Intern*

Geilenkirchen, Germany

*January 2016 – March 2016*

- Research labs: Freshman Laboratory of Electrical Engineering, Laboratory of Molecular Medicine and Cell, Biophysics Lab, Chemistry Laboratory, and Freshman Biomedical Labor
- Received certificates for contribution

## Publications

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(\*) Equal contribution

### 7. Speech Sentiment Analysis for Healthcare

Khai Le-Duc\*, Khai-Nguyen Nguyen\*, Long Vo-Dang, Truong-Son Hy  
Anonymity period, submitted to MLHC 2024

### 6. Vietnamese-English Machine Translation for Medical Conversations

Khai Le-Duc\*, Hung-Phong Tran, Long Vo-Dang, Khai-Nguyen Nguyen, Truong-Son Hy  
Anonymity period, submitted to MLHC 2024

### 5. Real-time Speech Summarization for Medical Conversations

Khai Le-Duc\*, Khai-Nguyen Nguyen\*, Long Vo-Dang, Truong-Son Hy  
Anonymity period, submitted to Interspeech 2024

### 4. VietMed-NER: Medical Named Entity Recognition from Speech

Khai Le-Duc, David Thulke, Hung-Phong Tran, Long Vo-Dang, Ralf Schlüter  
Public preprint comes soon, submitted to ACL 2024

### 3. Dynamic Intermediate Loss for Fine-tuning Self-Supervised Models

Khai Le-Duc\*, Christoph Lüscher\*, Ralf Schlüter  
Anonymity period, submitted to Interspeech 2024

### 2. VietMed: A Dataset and Benchmark for Automatic Speech Recognition of Vietnamese in the Medical Domain

Khai Le-Duc\*, Christoph Lüscher\*, Minh-Nghia Phan, Ralf Schlüter  
Accepted at LREC-COLING 2024

### 1. Development of Hybrid ASR Systems for Low Resource Medical Domain Conversational Telephone Speech

Christoph Lüscher, Mohammad Zeineldeen, Zijian Yang, Peter Vieting, Khai Le-Duc, Weiyue Wang, Ralf Schlüter, Hermann Ney  
ITG Speech Communication 2023

## Awards & Honors

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|   |         |
|---|---------|
| ORT Conference Participation Award  | 2024    |
| University Health Network   | 500 CAD |
| Top 12 HackerRank in Germany  | 2020    |
| HackerRank - the largest competitive programming platform in the world    |         |
| Valedictorian Scholarship of Vietnam National University Ho Chi Minh City | 2015    |
| Vietnam National University Ho Chi Minh City                              |         |

## Selected Open-Source Projects

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### Demo for Multilingual Speech Translation

- The first free-of-charge medical speech translation API in the world, being deployed on cloud in German medical centers to support conversations between German doctors and international patients without language barriers
- Co-contributor of the demo

### Awesome Competitive Programming Problems

- Curated extensive library of Python data structures and algorithms specifically designed for competitive programming contests
- Solved various problems including String Manipulation, Graph Theory, Greedy, Dynamic Programming, Sliding Window, Mathematics and Recursion
- On GitHub top 1 trending, received 170+ stars

## Other Experience

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|   |                              |
|---|------------------------------|
| <b>Mathnasium</b>   | October 2023 – November 2023 |
| Instructor - Part time  | Toronto, Canada              |
| <ul style="list-style-type: none"><li>• Communicated with students in an understandable way about daily lessons</li><li>• Developed automated teaching tools and methods to help students learn mathematics</li></ul>   |                              |
| <b>Techniker Krankenkasse</b>   | March 2016 – June 2016       |
| Volunteer - Full time   | Geilenkirchen, Germany       |
| <ul style="list-style-type: none"><li>• The company is Germany's largest health insurance fund</li><li>• Maintained business contacts with 1000+ student customers, organized and executed 3 events to advertise company's insurance packages, and created marketing concepts</li><li>• Received certificate for contribution</li></ul> |                              |

## *Technical Skills*

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### Programming skills:

- Programming Languages: Python, MATLAB, Java (basic)
- Databases (basic): Snowflake, SQL, MongoDB
- Deep Learning Frameworks: Keras, Tensorflow, Pytorch, Fairseq, HuggingFace
- Data Science Libraries: NumPy, SciKit-Learn, Pandas, SciPy, Seaborn, Matplotlib
- Data Analysis and Statistical Tools (basic): SPSS, Excel
- Image Processing Libraries: OpenCV, scikit-image
- Operating Systems: Linux, Git
- Document Preparation: LaTeX, Markdown

Relevant coursework: Medical Statistics, Information Processing, Image Processing, Medical Computer Science, Introducing MATLAB, Introducing to Python.

Spoken languages: Vietnamese (Native), English (IELTS 7.0), German (C1)