

# Cathal (Yeonhoon) Lee

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## WORK EXPERIENCE

### Korea Advanced Institute of Science and Technology

Remote

Machine Learning Intern - Statistical Speech and Sound Computing Lab (Supervisor: Hoirin Kim)

Sep 2025 – Present

- Researched emotion-controllable TTS by analysing and **fine-tuning** Autoregressive/Diffusion **Transformer architectures**
- **Identified built-in G2P limitations** and built a **two-stage phoneme→IPA conversion pipeline** reducing WER from 72% to 20%
- **Automated preprocessing of 10k+ hours** multi-speaker speech data using a scalable serialisation pipeline for large-scale experiments
- **Continuing collaborator, evaluating training-free methods**, adapting ideas from other domains such as LLMs and computer vision

### MAGO AI

Seoul, South Korea

Applied AI Intern

Jul 2025 – Sep 2025

- Contributed to a JSON-driven scenario builder for Voice AI; **MVP used in a commercial Proof-of-Concept with LG U+**
- Prototyped a lightweight **retrieval-augmented generation** pipeline for persona chatbot (chunking→vector embedding→top-k retrieval)
- Wrote LaTeX onboarding materials on dialogue systems, SER and Transformers, adopted by the engineering team

## PROJECTS

### “Inference-Time Metric Enhancement in DiT-TTS via Sequential Monte-Carlo Reward Alignment”

- Implemented an ODE→SDE conversion pipeline in PyTorch, enabling **stochastic sampling** and **controllable diversity** at inference time
- Experimented with an **SMC resampling** loop using a latent-space reward, applying an ESS threshold to avoid weight degeneracy
- Built a  **$\beta$ -annealed reward schedule** with early validity filtering for noisy mid-steps, then late alignment to reduce particle collapse

### “Sohri - Chatbot-Graph-Builder (MAGO AI Intern Project)”

- Built a **graph-based dialogue manager** that compiles JSON scenarios into a runnable **node-edge state machine** for task-oriented flows
- Added **config validation** such as **schema checks**, **unreachable node** and **cycle detection** to prevent runtime failures and loops
- Integrated intent/slot outputs (**Azure API**) into **transition guards** and **dialogue state updates**, persisting session state in **Redis (TTL)**
- **Deployed a FastAPI** demo-service behind Nginx with route separation and structured request logging to support database design

### “EmoSteer - Training-Free Emotion Control in Flow-Matching TTS via Activation Steering”

- Implemented paper-style residual activation steering in the **F5-TTS inference CLI** with steering modes in PyTorch
- Reproduced emotion2vec-based token selection (SER-scored importance→top-k masking and weighting) to target emotion

### “Group Theory behind Neo-Riemannian Chordal Transformation of Music Theory”

- Scientific Communication essay analysing the group-theoretic structure behind harmonic transformations in music theory [87%]

## EDUCATION AND QUALIFICATIONS

### University of Warwick

Coventry, United Kingdom

BSc Mathematics

Expected Graduation Date: Jun 2026

- Current Degree Classification: **First Class Honours**
- Modules: Measure Theory, Probability Theory, Machine Learning, Digital Signal Processing, Matrix Analysis and Algorithms

### Ardingly College

West Sussex, United Kingdom

- A Level: **Mathematics (A\*)**, **Further Mathematics (A\*)**, **Chemistry (A\*)** Sep 2019 – Jun 2021
- **Highest scorer in the Maclaurin and British Mathematical Olympiad**, Awarded Full Academic and Music Scholarship

## LEADERSHIP & EXTRACURRICULAR ACTIVITIES

### Warwick AI Society

Coventry, United Kingdom

Summit Coordinator

Sep 2024 – Present

- **Curated and coordinated the Warwick AI Summit**, recruiting speakers from Google, OpenAI, Anthropic and Alan Turing Institute
- Led end-to-end planning and the transition of the summit to a public-facing event, increasing attendance by **50% to 300+ participants**
- **Secured sponsorship from Jane Street and Anthropic** by pitching the summit’s technical focus and engaging directly with industry
- **Delivered a talk at the Summit** titled “*Can Machines Learn Emotion? – Zero-Shot Emotion Control in Text-to-Speech Models*”

### Republic of Korea Army

Paju, South Korea

Sergeant – Squad Leader and Translator

Oct 2022 – Apr 2024

- **Served as a squad leader**, responsible for personnel coordination and task execution in high-pressure operational environment
- Modelled an optimised daily meal allocation strategy, achieving a **5.6% reduction in food waste** through statistical analysis
- Selected as **designated translator** for ROK-US Combined Forces Command during UFS 2023, receiving an excellence commendation

## ADDITIONAL INFORMATION

**Languages:** Korean (Native), English (Native), Arabic (Intermediate), Mandarin (Intermediate)

**Skills:** Python (PyTorch, NumPy, SciPy), C#, Git, C++, Java, Docker

**Interests:** CrossFit, Cello, Jiu-jitsu