Xingyu Chen

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male | 25 | China Shanghai; Australia Canberra

Education

The Australian National University Aug 2022 - Jan 2024

Mphil in Audio & Acoustic Signal processing Group

The Australian National University Feb 2017 - Jun 2021

Bachelor of engineering (Honors) • Major : Mechatronics system

SKILLS

- **Programming:** Python, Matlab **Frameworks:** PyTorch, TensorFlow
- **Concepts:** Sound field estimation: spherical harmonics;
  Deep learning: physics-informed neural network, spherical CNN.

Research Experience

Head-Related Transfer Function Interpolation with a Spherical CNN Jun 2023 - Present

- CNN-based methods for HRTF interpolation showed promising results.
  However, CNN was primarily designed for processing signals in a 2D plane.
- The spherical CNN method exploits the spherical harmonics to circumvent the sphere-plane projection problem.
- Kernel functions expressed in the SH domain capture the spatial features of HRTF.
- It achieves higher accuracy and fewer model parameters compared to conventional CNNs.

Physics informed neural network for Audio & Acoustic problems Dec 2022 - Present

- Accurately estimating the sound field around a rigid sphere poses challenges due to limited sampling on the sphere.
- We proposed a PINN method that integrates physical constraints into both the network architecture and training process.
- Constraints are derived from the Helmholtz equation and the zero radial velocity condition on the rigid sphere.
- It mitigates ill-conditioning issues caused by truncation from limited measurements.

The modeling of drone noise in 3D sound fields Aug 2022 - Jan 2023

- Drone noise overpowered the target sound (-30dB), as the noise source was located closer to its microphone than the target.
- We designed a circular array and applied spherical signal processing methods to measure the noise distribution.
- We analyzed the noise characteristics and collected recognizable sounds using a drone-mounted microphone array.

Extended Kalman Filter based State estimation Sep 2021 - Mar 2022

The Chinese University of Hong Kong, Shenzhen Research Assistant

- The performance of EKF is limited due to the complexity being in the same order as the square of the state vector dimension.
- We proposed an approximation of the covariance matrix transmission and update on the Lie group to reduce complexity.
- Verified on the inertial navigation dataset, the result exceeds filter-based SLAM methods(Quaternion-based; Invariant EKF).

Publication (in chronological order)

1. **Chen, X.**, Ma, F., Zhang, Y., Bastine, A., & Samarasinghe, P. N. (2023). Head-Related Transfer Function Interpolation with a Spherical CNN. arXiv preprint arXiv:2309.08290.
2. Ma, F., Abhayapala, T. D., Samarasinghe, P. N., & **Chen, X.** (2023). Physics Informed Neural Network for Head-Related Transfer Function Upsampling. *arXiv preprint arXiv:2307.14650.*
3. **Chen, X.**, Ma, F., Bastine, A., Samarasinghe, P., & Sun, H. (2023). Sound Field Estimation around a Rigid Sphere with Physics-informed Neural Network. *Asia-Pacific Signal and Information Processing Association (APSIPA)*
4. Li, X., Jiang, H., **Chen, X.**, Kong, H., Wu, J. (2022). Closed-Form Error Propagation on SEn(3) Group for Invariant EKF With Applications to VINS. *IEEE Robotics and Automation Letters, 7(4), 10705-10712*

Other Experience

Tutor: ENGN4213-Digital Systems and Microprocessors

- Explain concepts of embedded microprocessor systems.
- Design an embedded system using C/C++ on microcontroller boards.

Python programming Contest 'Lanqiao': Third Prize in Overseas competition area