School of Computing, Engineering, and the Built Environment
Edinburgh Napier University

PHD STUDENT PROJECT

Funding and application details

Funding status: Self funded students only

Application instructions:
Detailed instructions are available at https://blogs.napier.ac.uk/scebe-research/available-phd-student-projects/

Prospective candidates are encouraged to contact the Director of Studies (see details below) to discuss the project and their suitability for it.

Project details

Supervisory Team:
- DIRECTOR OF STUDY: Prof Amir Hussain (Email: A.Hussain@napier.ac.uk)
- 2ND SUPERVISOR: Dr Mandar Gogate

Subject Group: Cyber-security and system engineering

Research Areas: Computer Science (Artificial Intelligence, Computer Vision, Cyber Security, Data Science, Human Computer Interaction, Internet of Things, Quantum Computing, Machine Learning), Engineering (Acoustics Engineering, Cybernetics, Mechatronics, Robotics, Syste

Project Title: Multiple PhD project topics available around Trustworthy AI-enabled multimodal assistive hearing and conversational technologies

Project description:
Flexible PhD project topics are available as part of the prestigious UK EPSRC funded Programme Grant: COG-MHEAR, led by Programme Director, Professor Amir Hussain.

As a PhD researcher, you will take a lead role in one of the COG-MHEAR research programme challenge areas under the direction of Prof. Hussain. You will have the

opportunity to work alongside renowned academics and other doctoral and postdoctoral researchers in our world-class, interdisciplinary Centres of: AI and Robotics; and Cybersecurity, IoT and Cyber-Physical Systems.

There will also be opportunities to carry out collaborative research on complementary topics as part of the EPSRC funded project on Natural Language Generation for Low-Resource Domains (NATGEN), which is co-led by Prof Hussain.

COG-MHEAR is a world-leading cross-disciplinary research programme funded under the EPSRC Transformative Healthcare Technologies 2050 Call. The programme aims to develop truly personalized multimodal assistive hearing and communication technology. It includes academic partners from 6 other UK Universities and a strong User Group comprising industrial and clinical collaborators, and end-user engagement organisations.

For more details, visit our website: https://cogmhear.org/.

We are looking for highly motivated applicants who will:

- Carry out highly-impactful supervised research in developing and evaluating trustworthy machine learning models for multi-modal hearing-aid speech enhancement and conversational dialog systems.
- Write-up high-quality peer-reviewed publications for leading journals and conferences.
- Exploit opportunities to collaborate with other PhD and postdoctoral researchers, COG-MHEAR partner companies, clinicians and end-users in the User Group
- Contribute to research and innovation proposals to secure future funding (e.g. for research/enterprise fellowships)

Any PhD project topic will be considered around developing and evaluating trustworthy machine learning models for multimodal hearing-aid speech enhancement and conversational dialog systems.

Example research areas of interest include:

- Trustworthy machine learning for multi-modal speech enhancement, separation and recognition
- Real-time augmented data-driven approaches to address related hearing-aid signal processing and integration challenges
- Emotion-sensitive natural language processing/generation and evaluation of multi-modal assistive hearing and conversational/dialog systems in low-resource domains
- Clinical and industrial applications (e.g human-robotics interaction, assistive technologies, wearable sensing, hardware/flexible electronics implementations, 5G-IoT and AR/VR use cases)

References:
[1] COG-MHEAR: http://cogmhear.org
[2] 2nd COG-MHEAR International AVSEC Challenge organised as part of the IEEE ASRU 2023 Workshop (job applicants are encouraged to register and participate in the Challenge and propose ideas for new low-latency audio-visual (AV) speech enhancement models for potential submission: https://challenge.cogmhear.org/#/
[3] Special Issue CFP on "Conversational AI" in the IEEE Transactions in Artificial Intelligence (ideas are welcome for papers that could potentially link

both COG-MHEAR and NATGEN related topics): https://cogmhear.org/assets/IEEE-TAI-Special-Issue.pdf

[4] Mandar Gogate, Kia Dashtipour, Ahsan Adeel, Amir Hussain, CochleaNet: A robust language-independent audio-visual model for real-time speech enhancement, Information Fusion, Volume 63, 2020, Pages 273-285, ISSN 1566-2535, https://doi.org/10.1016/j.inffus.2020.04.001.

[5] Hussain, Tassadaq, Mandar Gogate, Kia Dashtipour, and Amir Hussain. "Towards Intelligibility-Oriented Audio-Visual Speech Enhancement. - https://claritychallenge.github.io/clarity2021-workshop/papers/Clarity_2021_CEC1_paper_final_hussain.pdf

[6] [Code available at: https://github.com/cogmhear/Intelligibility-Oriented-Audio-Visual-Speech-Enhancement]

[7] Gao, Ruohan, and Kristen Grauman. "Visualvoice: Audio-visual speech separation with cross-modal consistency." In 2021 IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), pp. 15490-15500. IEEE, 2021 [Code available at: https://github.com/facebookresearch/VisualVoice]

[8] https://www.sciencedirect.com/science/article/pii/S1566253520302475

[9] https://www.sciencedirect.com/science/article/pii/S1566253518306018

[10] http://spandh.dcs.shef.ac.uk/chat2017/papers/CHAT_2017_hussain.pdf

[11] https://link.springer.com/content/pdf/10.1007/s12559-019-09653-z.pdf

[12] NATGEN paper: https://hbuschme.github.io/nlg-hri-workshop-2020/assets/papers/NLG4HRI_paper_12.pdf / https://gtr.ukri.org/projects?ref=EP%2FT024917%2F1 (NATGEN project has close/complementary links to COG-MHEAR e.g. shared interest in development and evaluation of low-latency and generalisable multi-modal neural network models. Another topic of shared interest is multi-modal speech and emotion-analysis models for cognitive load/listening effort detection and intelligibility prediction in conversational dialog systems).

Candidate characteristics

Education:

A first-class honours degree, or a distinction at master level, or equivalent achievements in AI, Computer Science, Informatics, Statistics, Mathematics, Electronic, Electrical, Computer, or Systems Engineering

Subject knowledge:

- At least one of: AI, Machine Learning, Probability and Statistics, Data Mining, Mathematics, Optimisation, Computer Vision, Speech Processing, Natural Language Processing, Robotics, Sensing, Communications, Electronics, Hardware Systems, Hearing Aids, IoT

Essential attributes:

- Experience of programming languages (such as Python, C#), and/or statistical analysis tools (such as R, Matlab).
- Some project topics will also require knowledge of machine learning and natural language processing techniques.

Desirable attributes:

- Background in at least one of: deep neural networks, speech processing, large language models, natural language processing, Edge AI, human-computer interaction, robotics, AR/VR, aud or related areas.