IMPERIAL

Research Associate in Generative AI and Information Theory for Communications

Department/Division/Faculty:	Electrical and Electronic Engineering
Campus/Location:	South Kensington
Job Family/Level:	Research Job Family, Research Associate* (Research salary scale)
Responsible to:	Professor Deniz Gunduz
Key Working Relationships (Co-supervisor):	Professor Krishna Narayanan and Professor Chao Tian (Texas A&M University, USA)
Contract type:	Full-time, fixed-term up to 24 months

Purpose of the Post

The post is funded by EPSRC as the UK component of a joint NSF–EPSRC project, "Neural Joint Source–Channel Coding: The Interplay Between Theory and Practice", between Imperial College London and Texas A&M University. Learned (neural) joint source–channel coding schemes have shown significant gains over conventional digital designs, together with graceful degradation under channel mismatch, but their inner workings remain poorly understood. The project uses information theory as its foundational tool to understand these schemes, so that they become computationally efficient, less storage-hungry, more adaptive and robust, and applicable to complex communication settings.

The post holder will carry out research at the intersection of information theory and machine learning, and contribute to project management and the supervision of PhD students. Potential research problems include, but are not limited to: the role of generative models (e.g., diffusion models) in compression and communication; the interpretability of learned codes and the interfaces they learn, studied on analytically tractable source models; neural coding for channels with feedback and for multi-user and relay networks; and adaptive, communication-efficient learning and inference at the network edge. The post holder will work closely with the project partners at Texas A&M University.

Key Responsibilities

Research Duties:

- To take initiatives in the planning of research
- To direct the work of small research teams

- To conduct data analysis
- To ensure the validity and reliability of data at all times
- To maintain accurate and complete records of all findings
- To write reports for submission to research sponsors
- To present findings to colleagues and at conferences
- To publish in leading venues in information theory, machine learning and communications
- To provide guidance to staff and students
- To attend relevant workshops and conferences as necessary
- To develop contacts and research collaborations within the College and the wider community
- To promote the reputation of the Group, the Department and the College
- To contribute to bids for research grants
- To conduct and plan own scientific work with appropriate supervision.
- To actively participate in the research programme of the Group
- To participate in Group research meetings and internal seminars
- To participate in regular joint project meetings with Texas A&M University and undertake research visits as appropriate
- To collaborate with other allied scientists within Imperial College and elsewhere in London and abroad, as appropriate
- To assist in the supervision of undergraduate and postgraduate research students and research assistants as required
- Any other duties as may be deemed reasonable by Head of group as well as Head of Division/Department/Section

Other Duties:

- To undertake any necessary training and/or development
- To undertake appropriate administration tasks
- To attend relevant meetings

Where Imperial or funder conditions necessitate, you will be required to complete timesheets for your work on projects in a timely manner.

Person Specification

Requirements Candidates/post holders will be expected to demonstrate the following:	**Essential (E)/ Desirable (D)**
Education	
Research Associate*: Hold a PhD in electrical engineering, computer science, mathematics, statistics, or a related field. Research Assistant: Hold a master's degree in electrical engineering, computer science, mathematics, statistics, or a related field and be near completion of a PhD. **Candidates who have not yet been officially awarded their PhD will be appointed as Research Assistant.*	E

Experience	
Practical experience within a research environment and / or publications at leading venues (e.g., IEEE Trans. IT, ISIT, IEEE JSAC, NeurIPS, ICML, ICLR)	E
Experience of dealing with academic and industrial collaborators	D
Strong expertise in one or more of the following, and willingness to learn the others: • Information theory (e.g., rate – distortion theory, joint source – channel coding, multi-user information theory). • Coding and communication theory. • Design and training of deep neural networks, including generative models (e.g., diffusion models, transformers). • Optimisation methods. • Implementation of algorithms via computer simulation	E
Experience with programming in Python and deep learning frameworks (e.g., PyTorch or JAX)	E
Prior research on learned compression, neural channel coding, joint source–channel coding, or semantic/task-oriented communication	D
Hands-on experience with diffusion models, transformers or other generative models	D
Experience with software-defined radio or wireless prototyping	D

Knowledge	
Knowledge of at least one of information theory, coding theory, communication theory or learning theory, and familiarity with modern machine learning methods.	E
Knowledge of research methods and statistical procedures	E

Skills & Abilities	
Ability to conduct a detailed review of recent literature	E
Ability to develop and apply new concepts	E
Creative approach to problem-solving	E
Excellent verbal communication skills and the ability to deal with a wide range of people	E
Excellent written communication skills and the ability to write clearly and succinctly for publication	E
Ability to organise own work with minimal supervision	E
Ability to prioritise own work in response to deadlines	E
Ability to direct the work of a small research team and motivate others to produce a high standard of work	D
Willingness to work as part of a team and to be open-minded and cooperative	E
Flexible attitude towards work	E

Discipline and regard for confidentiality and security at all times	E
Willingness to undertake any necessary training for the role	E
Willingness to travel both within the United Kingdom and abroad to conduct research and attend conferences	E

Further Information

Please note that job descriptions cannot be exhaustive, and the post-holder may be required to undertake other duties, which are broadly in line with the above key responsibilities.

Our values are at the root of everything we do and everyone in our community is expected to demonstrate Imperial:

- Respect
- Collaboration
- Excellence
- Integrity
- Innovation

Employees are also required to comply with all Imperial policies and regulations.

We are committed to equality of opportunity, to eliminating discrimination and to creating an inclusive working environment for all. We encourage candidates to apply irrespective of age, disability, marriage or civil partnership status, pregnancy or maternity, race, religion and belief, gender reassignment, sex, or sexual orientation. You can read more about our commitment on our webpages.

Imperial is a proud signatory to the San-Francisco Declaration on Research Assessment (DORA), which means that in hiring and promotion decisions, we evaluate applicants on the quality of their work, not the journal impact factor where it is published. For more information, see https://www.imperial.ac.uk/research-and-innovation/about-imperial-research/research-evaluation/

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