PhD Position Announcement

Project title: Advanced optical fibre sensors for bioengineering applications.

Host institution: Department of Electrical Engineering, Computer Engineering and Informatics, Cyprus University of Technology (CUT), Limassol.

Background and motivation

Optical fibre sensors have emerged as one of the most promising sensing platforms for biomedical applications, owing to their inherent properties: extremely small dimensions, mechanical flexibility, biocompatibility, immunity to electromagnetic interference, ability to operate in fluidic and biological environments, and the capacity to simultaneously sense multiple physical and chemical quantities along the length of the fibre. Technologies such as fibre Bragg gratings (FBGs) and long-period gratings, interferometric sensors, sensors based on microstructured and specialty polymer fibres, as well as sensors enhanced with functional or plasmonic coatings (LSPR/SPR), nowadays enable measurements of temperature, strain, pressure, pH, refractive index, and the selective detection of biomarkers.

In bioengineering, such sensors open up new horizons in minimally invasive diagnostic techniques, in-vivo monitoring of physiological parameters, biomechanical tissue analysis, sensor-guided surgery, smart implants, and wearable / on-body diagnostic devices. Despite significant progress, important challenges remain in the precise inscription and fabrication of structures within the fibre (e.g. femtosecond laser inscription, plane-by-plane and point-by-point techniques), in the integration of bioactive coatings, in calibration within complex biological environments, and in the reliable multi-parameter demultiplexing of the optical signal. Addressing these challenges forms the core of the present position.

Objectives of the doctoral research

The successful candidate will work on the development of methodologies, devices and prototypes that will enable optical fibre sensors to meet the requirements of modern biomedical applications. Specifically, the research will address:

1. The design, inscription and characterisation of new sensing structures in optical fibre (e.g. FBGs, long-period gratings, interferometric structures) using laser inscription techniques, tailored to the sensitivity, spatial resolution and biocompatibility requirements of biomedical applications.
2. The development and experimental validation of multi-parameter sensing techniques – simultaneous measurement of temperature, strain, pressure and/or biochemical quantities – with calibrated accuracy, repeatability and stability under realistic operating conditions.
3. The integration of functional / bioactive coatings for the selective detection of biomarkers, with assessment of their chemical stability, biocompatibility and sensing performance under in-vitro conditions.

4. The evaluation of the developed devices in representative biomedical use scenarios (e.g. minimally invasive monitoring, biomechanical measurements, functional prototypes), in collaboration with medical and biological partners where appropriate.

The research will be conducted in the modern photonics and optical fibre laboratories of CUT, and is expected to result in publications in leading international journals of the field (e.g. Optics Express, Optics Letters, Journal of Lightwave Technology, IEEE Sensors Journal, Biosensors and Bioelectronics) and in major international conferences.

Required qualifications

- A degree in Electrical Engineering, Physics or a closely related field, from a recognised university.
- A Master's degree in a related subject (or equivalent completion by the start of the position) is considered a strong advantage.
- A solid understanding of the fundamentals of optics, photonics and/or electromagnetism.
- Willingness and ability to engage in systematic experimental laboratory work, with attention to detail and measurement accuracy.
- Excellent command of English (written and spoken).
- Full-time commitment: the position requires full-time engagement from the successful candidate.

Desired qualifications

- Experience with and knowledge of laser systems (e.g. femtosecond, pulsed or tunable laser sources) is considered a significant advantage.
- Experience in optical / photonic laboratory techniques: alignment of optical setups, use of optical spectrum analysers (OSA), interrogators, fusion splicing of optical fibres.
- Familiarity with simulation tools (COMSOL Multiphysics, Lumerical, OptiSystem or equivalent) and programming in MATLAB and/or Python for signal processing and data analysis.
- Previous experience in or strong interest in interdisciplinary work in bioengineering, biosensors or medical physics.
- Previous publications in international journals or conferences.

Terms of employment

- **Duration:** Three (3) to four (4) years of full-time employment, with annual progress evaluation.
- **Scholarship / remuneration:** Full funding, in accordance with the regulations of CUT and the relevant funding body.
- **Location:** Limassol, Cyprus, with the possibility of research visits to collaborating institutions abroad.

- **Infrastructure:** Access to state-of-the-art photonics and optical fibre sensing laboratory equipment at CUT, including laser inscription and optical characterisation facilities.

Application package

Interested candidates are invited to submit:

5. A detailed curriculum vitae.
6. Copies of degrees and academic transcripts.
7. A cover letter (up to 2 pages) describing the candidate's research interests, their relation to the subject of the position, and preliminary research ideas.

Supervisor: Prof. Kyriacos Kalli, Department of Electrical Engineering, and Computer Science and Engineering, Cyprus University of Technology (CUT).

Contact: kyriacos.kalli@cut.ac.cy

The Cyprus University of Technology is an equal opportunities employer and welcomes applications from candidates of all genders and backgrounds.

PhD Position Announcement

Self-Adaptive Multi-Agent LLM Systems: Test-Time Inference of the Optimal Number of Agents for Trustworthy and Compute-Efficient Artificial Intelligence

Funding context: Pharos-CY project (the AI Factory Antenna of Cyprus, funded by EuroHPC JU and the Republic of Cyprus).

Host institution: Department of Electrical Engineering, Computer Engineering and Informatics, Cyprus University of Technology (CUT), Limassol.

Supervisor: Prof. Sotirios P. Chatzis, Laboratory Director.

Background and motivation

Pharos-CY is the Cypriot Antenna of the pan-European AI Factories network, implemented in close institutional collaboration with the Greek AI Factory "Pharos" and the DAEDALUS supercomputing infrastructure. Its core pillars include the development of trustworthy, high-value Artificial Intelligence; the development of language models adapted to Greek and to the Cypriot dialect; and AI applications in healthcare, sustainability, and culture.

In this context, multi-agent LLM systems represent an emerging paradigm for complex reasoning tasks, clinical decision support, dialogue in Greek/Cypriot, and document analysis. Despite the field's rapid progress, a fundamental question remains open: how many agents are sufficient for any given query, and how can this be inferred autonomously by the system itself at test time, without externally fixed hyperparameters? Recent works (MAS-Orchestra, FutureWeaver, AgentTTS, M1/CEO-agent, DyLAN) have identified the problem, yet a theoretically grounded and statistically principled approach remains an open research direction.

Objectives of the doctoral research

The successful candidate will work on developing methodologies that enable multi-agent LLM systems to:

1. dynamically infer the number of agents (team cardinality) required for each query, based on the uncertainty, difficulty, and structure of the underlying problem;
2. optimally allocate the available computational budget (test-time compute) between agents and reasoning steps, leveraging Bayesian and MCMC-based sampling techniques;
3. provide reliability guarantees and calibrated uncertainty in their final decisions, in alignment with the requirements of the EU AI Act and the GDPR;
4. be evaluated on applications aligned with the Pharos-CY pillars, with emphasis on healthcare scenarios (e.g., clinical decision support) and Greek/Cypriot language settings.

The research will leverage the DAEDALUS supercomputing infrastructure and is expected to result in open-source tools and publications at top international venues (NeurIPS, ICLR, ICML, AAAI).

Required qualifications

- Bachelor's and Master's degree (or equivalent completion expected by the start of the position) in Computer Science, Computer Engineering, Electrical Engineering, Applied Mathematics, Statistics, or a related field.
- Strong background in machine learning and deep learning, with demonstrable familiarity with modern language models.

- Solid grounding in probability and statistical inference; experience with Bayesian inference and Monte Carlo / MCMC methods is considered a strong advantage.
- Excellent command of Python and experience with PyTorch or JAX; experience with distributed training/inference on HPC systems is desirable.
- Very good command of English, both written and spoken.

Desirable qualifications

- Prior publications at international ML/AI conferences or journals.
- Experience with agentic frameworks (LangGraph, AutoGen, CrewAI, or similar) and/or post-training techniques (RLHF/RLVR, DPO).
- Interest in trustworthy AI, interpretability, and AI safety.
- Knowledge of Greek (facilitates interaction with the language-related pillars of Pharos-CY, but is not a prerequisite).

Terms of employment

- **Duration:** up to three (3) years of full-time employment, with annual progress review.
- **Funding:** full scholarship/salary funded by the Pharos-CY project, in accordance with the regulations of CUT and EuroHPC JU.
- **Location:** Limassol, Cyprus, with the possibility of research visits to partner institutions (Cyprus Institute / CaSToRC, GRNET, and European partners of the AI Factories network).
- **Infrastructure:** access to the DAEDALUS supercomputing infrastructure and to the data and services of the Pharos-CY ecosystem.

Application package

Interested candidates are invited to submit the following:

5. Detailed curriculum vitae.
6. Copies of academic degrees and full transcripts.
7. A cover letter (up to 2 pages) describing the candidate's research interests, their relation to the topic of the position, and preliminary research ideas.

Supervisor: Prof. Sotirios Chatzis, Department of Electrical Engineering, and Computer Science and Engineering, CUT.

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