

# Neuromorphic Computing and Sensing with Micro-Electro-Mechanical Systems (MEMS)



## NeuMat Summer Studentship Application

February 2026

Host institution:  
**Dept. of Engineering, University of Cambridge**

Supervisor(s):

**Mohammad Zaid**  
PhD, Trinity College  
Krishnan-Ang Scholar  
University of Cambridge  
[mz503@cam.ac.uk](mailto:mz503@cam.ac.uk)

**Prof. Ashwin Seshia FEng**  
Dept. of Engineering  
Fellow, Queens' College  
University of Cambridge

# **Neuromorphic Computing and Sensing with MEMS: Piezoelectric Micromachined Ultrasound Transducers**

## **1. Project Summary**

Neuromorphic computing seeks to move beyond conventional digital architectures by drawing inspiration from how systems sense, process, and adapt to information. While much neuromorphic research focuses on algorithms and software, there is growing interest in physical neuromorphic hardware, devices whose intrinsic physics naturally implements neuron-like behaviour.

This project explores how **Micro/Nano-Electro-Mechanical Systems** (MEMS / NEMS) and resonant devices fabricated from polar piezoelectric thin films can act as physical neuromorphic elements. By exploiting nonlinearity, resonance, hysteresis, and electromechanical memory effects, such devices offer a route toward low-power, adaptive, and interpretable neuromorphic systems.

Using piezoelectric micromachined ultrasonic transducers (PMUTs) as a model platform, the student will investigate device behaviour under electrical and mechanical excitation, drawing analogies to neuronal phenomena such as thresholding, integration, adaptation, and state-dependent response. The project combines experimental characterisation, electronic interfacing, modelling, and algorithmic analysis, providing a rare opportunity to work across the full hardware-to-AI stack.

## **2. Technical Scope (What You Will Do)**

No prior experience is required. The student will gain hands-on engineering experience across one/multiple layers of the stack:

### **I. Device & Experimental Work**

- Electrical and Optical characterisation of MEMS/NEMS resonators
- Measurement of nonlinear, hysteretic, and state-dependent behaviour
- Exposure to advanced, state-of-the-art instrumentation

### **II. Electronics & Systems**

- Interfacing micro-devices with analogue and mixed-signal circuits (training on KiCAD/Altium for circuit design + assembling electronic components on PCB boards will be provided)
- Understanding signal conditioning, noise, and stability in real hardware
- Exploring circuit-level implementations of neuromorphic behaviour
- Modelling & Computation (COMSOL Multiphysics, FreeFEM++, Ansys, FlexPDE, SPICE)
- Physical and reduced-order modelling of resonant systems
- Time-series and frequency-domain signal analysis

### **III. AI / Machine Learning for behaviour classification and representation**

No prior MEMS experience is required - training will be provided.

### 3. Who Should Apply

We welcome applications from undergraduate students (typically 2<sup>nd</sup> to 4<sup>th</sup> year) in:

- Engineering (Electrical, Electronic, Mechanical, Materials, Systems)
- Physics or Applied Physics
- Computer Science (with interest in hardware or physical systems)
- Related quantitative disciplines

Ideal candidates are curious, motivated, and excited by hands-on research at the boundary between physical devices and computation. The project is suitable both for students considering a PhD and those exploring research for the first time.

Eligibility: Applicants must be **undergraduate** students (typically in their 2<sup>nd</sup>, 3<sup>rd</sup>, or 4<sup>th</sup> year at the time of application) registered at a UK higher education institution, in engineering, physics, computer science, or a closely related discipline, with an interest in neuromorphic materials, devices, or hardware-oriented AI.

### 4. Deliverables from the NeuMat - Cambridge Collaboration

The NeuMat - Cambridge collaboration will deliver a **fully funded 8-week summer research placement hosted at the University of Cambridge**.

The funding will cover the student stipend, accommodation, travel, and subsistence, ensuring that participation is not limited by financial constraints.

The collaboration will provide dedicated supervision, access to laboratory facilities, electronic instrumentation, and computational resources, and a clearly defined research programme aligned with NeuMat's focus on neuromorphic materials and systems.

The placement will result in documented experimental workflows, reusable datasets, and validated analysis methods, which will be retained within the NeuMat network and used to support future studentships, follow-on projects, and cross-institutional collaboration.

### 5. Research Environment

Research will primarily take place at the **Department of Engineering, University of Cambridge**, a world-leading centre for engineering research that brings together materials, microsystems, electronics, computation, and artificial intelligence.

The student will work within a collaborative, interdisciplinary environment with access to advanced characterisation facilities, electronic and computational infrastructure, and a strong culture of hands-on experimentation and rigorous modelling.

The project will be led by **Mohammad Zaid** (PhD, Trinity College, University of Cambridge) along with support from **Prof. Ashwin Seshia** (FREng, University of Cambridge).

Emphasis will be placed on practical skills including device characterisation, electronic interfacing, data acquisition, modelling, and algorithm development, ensuring exposure to the full hardware-to-software stack.

Appropriate arrangements for access, accommodation, and wellbeing will be in place to enable the student to fully engage in the 8-week placement and to gain a rigorous, high-quality first research experience at the intersection of materials, microsystems engineering, neuromorphic hardware, and artificial intelligence.

## 6. How to Apply

Interested students should submit a **single PDF application** containing the following:

### 1. Curriculum Vitae (CV, max 2 pages)

Including education, relevant coursework, technical skills, and any prior research or project experience.

### 2. Statement of Interest (max 500 words)

Briefly describing:

- Technical interests
- Motivation for applying to this project
- What the applicant hopes to learn during the placement
- Any relevant experience in engineering, physics, computation, or experimental work
- Future Goals

Please include your LinkedIn profile / website (if any).

### 3. Academic Referee

Applicants are required to provide the **name, institutional affiliation, and contact details of one academic referee** who is familiar with their academic performance and technical ability (e.g. a course instructor, project supervisor, or academic advisor).

A **reference letter is not required at the application stage**. Referees may be contacted **only for shortlisted candidates**. Applicants should ensure that their referee is willing to provide a reference if requested.

References from non-academic sources (e.g. industry placements) are acceptable **only if they can comment on the applicant's technical or research capability**.

Applications should be submitted by **23:59 (UK time) on Friday 6th March 2026** to [\*\*mz503@cam.ac.uk\*\*](mailto:mz503@cam.ac.uk) with the subject line:

**“NeuMat x Cambridge Summer Studentship 2026 - <name>”**

Shortlisted candidates will then be invited for a brief interview. Selection will be based on academic preparation, motivation, and alignment with the project theme.

## 7. Life at University of Cambridge



Cambridge has been the birthplace of many ideas and technologies that define modern science and engineering. Notable scientists associated with the university include Isaac Newton, Ernest Rutherford, J. J. Thomson, James Clerk Maxwell, Alan Turing, Srinivasa Ramanujan, alongside over 120 Nobel Prize winners and many other scientists and engineers whose work has shaped the modern world. Most of your research work during the 8-week stay will take place in West Cambridge and around the Cavendish Laboratory. Because research here is highly diverse and interdisciplinary, you will often move between state-of-the-art laboratories, each with its own specialist equipment and techniques. This hands-on exposure to different labs is a normal and exciting part of research life at Cambridge. Today, West Cambridge is also one of the leading centres for AI in Europe, and the wider Cambridge technology ecosystem is commonly known as Silicon Fen, reflecting its role as a global hub for innovation.

Student life in Cambridge is friendly, supportive, and easy to settle into. During your stay, you will experience the unique Cambridge college culture, where students live, eat, and socialise together. This includes traditional formal dinners, informal talks, sports, society events, and social activities. Outside the colleges, Cambridge offers world-renowned cafés and restaurants, historical sites, and scenic walks along the river. The city is small, safe, and easy to navigate by walking or cycling, and its vibrant international student community means you will meet people from many different cultures. Research groups are collaborative, supervisors are approachable, and there is a strong culture of asking questions and learning by doing. Overall, Cambridge offers a comfortable, inspiring environment to conduct exciting research while enjoying a rich and memorable student experience.