PhD student in developing edge AI model for multilayer electrospinning process control

Summary

Electrospinning is a flexible, scalable and affordable method to deposit nanofibrous layers, including composite multilayer membranes. Currently, there are 1) no readily available nanofiber quality models for multilayer membranes, and 2) no robust and scalable methods for model-based control of multilayer electrospinning. The task of the PhD student is constructing a scalable, multiparameter model, which maps online observable process parameters (e.g. spinneret voltage, flow rate etc.) to nanofiber product quality (e.g. morphology, diameter variance, all of which are only observable offline with profilometry and SEM), for a wider selection of materials than is currently possible. The multi-dimensional nature of the model likely necessitates a machine learning based approach, yet should be minimally capable of running on the edge, ideally of running on power-efficient embedded hardware. The ultimate goal is to demonstrate the viability of the developed approach in multilayer electrospinning. The project is part of Estonian Research Council project PSG897 "Cogni-E-spin: Cognitronic Electrospinning System for Automated Quality Control of Nanofiber Product", which aims to create the technologies for scalable inline quality control of electrospun nanofiber meshes.

Research field:	Information and communication technology
Supervisors:	Dr. Tamas Pardy Ferenc Ender
Availability:	This position is available.
Offered by:	School of Information Technologies Thomas Johann Seebeck Department of Electronics
Application deadline:	Applications are accepted between October 01, 2024 00:00 and October 25, 2024 23:59 (Europe/Zurich)

Description

We are looking for a highly motivated and ambitious PhD candidate with experience in either biomedical engineering, machine learning, polymer technology, physics, electrospinning, or similar fields, to join our Lab-on-a-chip team (Website | Facebook) at Tallinn University of Technology (TalTech) and Budapest University of Technology and Economics (BME). Electrospinning is a flexible, scalable and affordable method to deposit nanofibrous layers, including composite multilayer membranes. Currently, there are 1) no readily available nanofiber quality models for multilayer membranes, and 2) no robust and scalable methods for model-based control of multilayer electrospinning. The task of the PhD student is constructing a scalable, multiparameter model, which maps online observable process parameters (e.g. spinneret voltage, flow rate etc.) to nanofiber product quality (e.g. morphology, diameter variance, all of which are only observable offline with profilometry and SEM), for a wider selection of materials than is currently possible. The multi-dimensional nature of the model likely necessitates a machine learning based approach, yet should be minimally capable of running on the edge, ideally of running on power-efficient embedded hardware. The ultimate goal is to demonstrate the viability of the developed approach in multilayer electrospinning.

The project is part of Estonian Research Council project PSG897 "Cogni-E-spin: Cognitronic Electrospinning System for Automated Quality Control of Nanofiber Product", which aims to create the technologies for scalable inline quality control of electrospun nanofiber meshes. The project is endorsed by industrial partners in Estonia and Hungary.

Possible research questions:

- What are the empirical methods, which aim to characterize the physico-chemical processes that affect nanofiber quality?
- For new materials (layers), what is the most efficient analytical approach (e.g. weight, profilometry, SEM) to calibrating the quality model?
- How can AI based methods be used to fit empirical data to existing nanofiber quality models?
- What are the optimal hardware-software architectures for deploying the above methods, test and validate the model?

Applicants should fulfil the following requirements:

- MSc either in biomedical engineering, polymer technology, applied physics, chemical engineering or related fields
- Have a clear interest in the topic of the position
- Excellent command of English
- Good candidate should like to play for a dynamic, interdisciplinary, and international team
- Successful candidate should have prior experience in at least one of those areas: analytical methods (e.g. profilometry, SEM), machine learning and/or modelling, embedded software, polymer technology

The following experience is beneficial, but not required:

- Experience with nanofiber meshes

We offer:

- 4-years PhD programme in cooperation of TalTech Estonia and BME Hungary, both are in the top 2% of global university rankings
- PhD/early-stage researcher position at TalTech with regular site visits at BME
- Opportunities for conference visits, research stays and interdisciplinary networking with partners both locally and internationally,
- Specific trainings taking into account the core skills of the candidate,
- Starting salary of 2300 €/month gross, with a possibility to increase,
- Position comes with full social and medical benefits in Estonia
- For further information and details about applying, please contact Dr. Tamas Pardy (tamas.pardy@taltech.ee) and Dr. Ferenc Ender (ender.ferenc@vik.bme.hu) with Cogni-E-Spin in the e-mail title.

About the department
The Thomas Johann Seebeck Department of Electronics at Tallinn University of Technology offers a dynamic and innovative environment for PhD students interested in electronics and communication technologies.

- **Research Focus:** The department specializes in Cognitive Electronics and Communication Technologies, aligning its research with industry interests and future development trends.
- **Laboratory Facilities:** Students have access to a robust laboratory infrastructure, providing practical skills essential for professional careers.
- **Historical Significance:** Named after the renowned physicist Thomas Johann Seebeck, the inventor of the thermoelectric effect, the department carries a legacy of pioneering research in thermoelectricity, magnetics, and optics.
- **Curriculum:** The department is involved in the Communicative Electronics Master's program, which feeds into the PhD studies, ensuring a comprehensive educational pathway from undergraduate to doctoral levels.
- **Industry Collaboration:** There is a strong emphasis on cooperation with both local and international companies, government bodies, and organizations, enhancing the practical impact and relevance of research.

For detailed information on the PhD program, including specific research projects and opportunities for collaboration, prospective students can visit the department's official website.

To get more information or to apply online, visit https://taltech.glowbase.com/positions/846 or scan the the code on the left with your smartphone.