

Post-doctoral position open

AI-based method for microplastic particle identification and classification based on image analysis and with Raman spectra as reference

1 Information about the post-doctoral position

Status: R&D employee of the startup company IZONICS,

Duration: 12 months, with perspective enrolment as permanent staff (CDI).

Scientific and technical supervision:

- Prof. Eva Dokladalova, Université Gustave Eiffel, ESIEE Paris, LIGM Lab.
- Prof. Tarik Bourouina, Université Gustave Eiffel, ESIEE Paris, ESYCOM Lab. and Co-founder of IZONICS

Other project's members:

- Dr. Ahmed ELSAYED, Dr. Mazen ERFAN, M. Aly KARAKAMO, Co-founders of IZONICS.

Framework: Joint project between Université Gustave Eiffel and the startup company IZONICS, with the support of SATT ERGANE0, in the frame of the Sci-ty programme.

Location: ESIEE Paris, Campus of Cité Descartes at Marne-la-Vallée.

Keywords: Artificial Intelligence, Deep Neural Networks, Deep nets, Microscopic imaging, Raman spectroscopy, Image analysis, Identification, Classification, Data acquisition, Database building,

2 Missions

In this project, within ESIEE School of Engineering, a founding member of Université Gustave Eiffel, the ESYCOM and LIGM laboratories join forces with the young start-up IZONICS, whose aim is to advance the maturation of an innovative technology for low-cost and effective detection and recognition of microplastic particles in water [1].

This technology is based on a combination of Raman spectroscopy and microscopic imaging [2, 3]. While Raman spectroscopy is fairly well mastered today, its effective combination with microscopic imaging has yet to be fully exploited. However, this combination could bring several advantages, from faster processing to the possibility of developing new methods for the analysis of microscopic images [4].

The objective of this project is to work and implement complete and efficient methods for the detection and recognition of particles, to offer new opportunities and applications for water analysis.

Several steps will have to be carried-out, such as validation of the parameters of the data acquisition chain, evaluation and development of data analysis methods, and definition and implementation of demonstration applications. A significant part will also be devoted to the creation of the dataset (non-existent today for the microscopic imaging part).

If the candidate is interested, he can optionally contribute to the implementation part of the hardware system.

3 Activities

- join a research lab to conduct innovative R&D and join a startup team to contribute to its development
- conduct research in the field of data analysis in the field of AI-based methods applied to microplastic particle detection and recognition
- participation in the implementation and prototype validation
- coordination of development outsourcing
- supervision of internship students can be considered.

4 Skills

Applicants are required to have:

A PhD in Computer Science or Embedded Systems

Advanced skills in Python programming are mandatory.

A strong background in Machine Learning & Deep Learning on images and/or text using related libraries (scikitlearn, Tensorflow, Pytorch, etc.).

A motivation to learn data acquisition process

Fluency in written and spoken English is essential.

5 Application

Applicants should send an email to: eva.dokladalova@esiee.fr and tarik.bourouina@esiee.fr

A full curriculum vitae including a complete list of publications and previous achievements

A one-page research statement discussing how the candidate's background fits the proposed topic

Two support letters or contact information of 2 references (former supervisors)

6 References

- [1] A. A. Koelmans, N. H. Mohamed Nor, E. Hermsen, M. Kooi, S. M. Mintenig, et J. De France, « Microplastics in freshwaters and drinking water: Critical review and assessment of data quality », *Water Research*, vol. 155, p. 410-422, mai 2019, doi: 10.1016/j.watres.2019.02.054.
- [2] J. Lorenzo-Navarro *et al.*, « Deep learning approach for automatic microplastics counting and classification », *Science of The Total Environment*, vol. 765, p. 142728, avr. 2021, doi: 10.1016/j.scitotenv.2020.142728.
- [3] R. Rosal, « Morphological description of microplastic particles for environmental fate studies », *Marine Pollution Bulletin*, vol. 171, p. 112716, 2021, doi: <https://doi.org/10.1016/j.marpolbul.2021.112716>.
- [4] J. Shan, J. Zhao, Y. Zhang, L. Liu, F. Wu, et X. Wang, « Simple and rapid detection of microplastics in seawater using hyperspectral imaging technology », *Analytica Chimica Acta*, vol. 1050, p. 161-168, mars 2019, doi: 10.1016/j.aca.2018.11.008.