



# PhD Positions in Signal Processing and Machine Learning for Multimodal Molecular Imaging

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**Challenge:** Build 3-D molecular atlases of human organs.

**Change:** Signal processing/machine learning for high-dimensional imaging.

**Impact:** Decipher spatiotemporal cellular diversity in human tissue.

## Job description

The Van de Plas lab is offering PhD positions in signal processing and machine learning for multimodal imaging, to build 3-D molecular atlases of human tissue. The positions have a special focus on spectral imaging modalities such as imaging mass spectrometry and multiplexed immunofluorescence microscopy, as well as on exceptionally large and high-dimensional data.

Our lab is located at the Delft University of Technology (TU Delft) in the Netherlands and is part of the Delft Center for Systems and Control. Our research lies at the interface between (i) mathematical engineering and machine learning; (ii) analytical chemistry and instrumentation; and (iii) life sciences and medicine. We explore new ways of acquiring, processing, and mining the massive (multi-terabyte) datasets that imaging mass spectrometry and other molecular imaging modalities commonly deliver.

Research topics of interest for these positions include:

- Signal processing (e.g. noise removal, automated feature detection, etc.);
- Dimensionality reduction and transformations (e.g. Fourier & wavelet transforms, dictionary learning, etc.);
- Pattern recognition and factorization in large datasets (e.g. non-negative matrix/tensor factorization, etc.);
- Supervised, semi-supervised, and unsupervised machine learning (e.g. multivariate regression, tumor/abscess classification, manifold learning, etc.);
- Mathematical optimization & casting problems in biology into a computer-solvable form (e.g. convex optimization, automated anatomical interpretation);
- Data mining across different imaging sensors and technologies (e.g. data-driven multimodal image fusion).

Our lab has a strong network of international collaborators in both academia and industry. Collaborators include chemistry and instrument partners, such as the Mass

Spectrometry Research Center, Caprioli lab, and Spraggins lab at Vanderbilt University (Nashville, TN, U.S.A.), as well as medicine and biology partners, such as the Swinnen lab at the Dept. of Oncology of the KU Leuven University Hospital (Leuven, Belgium).

You will have the opportunity to participate in one or more of our ongoing multidisciplinary research projects:

- Two projects within the Human BioMolecular Atlas Program ([HuBMAP](#)) of the United States' [National Institutes of Health](#), which aims to build a 3-D molecular atlas of the human body at single-cell resolution. One project focuses on the human kidney, while the other explores the human eye and pancreas. Both projects are in close collaboration with Vanderbilt University (Nashville, TN, U.S.A.).
- Two National Institutes of Health projects on the molecular imaging of microbial communities and infectious disease, in collaboration with the Vanderbilt University Medical Center (Nashville, TN, U.S.A.).
- SMART BRAIN, a FLAG-ERA JTC project in collaboration with the University of Modena and Reggio Emilia (Italy) through which our lab is an associated member of Europe's Human Brain Project Flagship.

## Requirements

Applicants should have:

- A Master degree in a relevant field, i.e. Engineering, Computer Science, Systems & Control, Statistics, Computational Physics, or any domain related to the lab's research topics.
- A background in image & signal processing, machine learning, numerical analysis, or statistics.
- Strong motivation to work in a multidisciplinary environment and interact with collaborators in medicine, biology, chemistry, and physics is essential.
- Good command of English is required.

Experience in mass spectrometry, chemistry, or biotechnology is a plus.

Doing a PhD at TU Delft requires English proficiency at a certain level to ensure that the candidate is able to communicate and interact well, participate in English-taught Doctoral Education courses, and write scientific articles and a final thesis. For more details please check the [Graduate Schools Admission Requirements](#).

## Conditions of employment

Doctoral candidates will be offered a 4-year period of employment in principle, but in the form of 2 employment contracts. An initial 1,5 year contract with an official go/no go progress assessment within 15 months. Followed by an additional contract for the remaining 2,5 years assuming everything goes well and performance requirements are met.

Salary and benefits are in accordance with the Collective Labour Agreement for Dutch Universities, increasing from € 2443 per month in the first year to € 3122 in the fourth year. As a PhD candidate you will be enrolled in the TU Delft Graduate School. The TU

Delft Graduate School provides an inspiring research environment with an excellent team of supervisors, academic staff and a mentor. The Doctoral Education Programme is aimed at developing your transferable, discipline-related and research skills.

The TU Delft offers a customisable compensation package, discounts on health insurance and sport memberships, and a monthly work costs contribution. Flexible work schedules can be arranged. For international applicants we offer the Coming to Delft Service and Partner Career Advice to assist you with your relocation.

## TU Delft (Delft University of Technology)

Delft University of Technology is built on strong foundations. As creators of the world-famous Dutch waterworks and pioneers in biotech, TU Delft is a top international university combining science, engineering and design. It delivers world class results in education, research and innovation to address challenges in the areas of energy, climate, mobility, health and digital society. For generations, our engineers have proven to be entrepreneurial problem-solvers, both in business and in a social context. At TU Delft we embrace diversity and aim to be as inclusive as possible (see our [Code of Conduct](#)). Together, we imagine, invent and create solutions using technology to have a positive impact on a global scale.

Challenge. Change. Impact!

## Faculty Mechanical, Maritime and Materials Engineering

The Faculty of 3mE carries out pioneering research, leading to new fundamental insights and challenging applications in the field of mechanical engineering. From large-scale energy storage, medical instruments, control technology and robotics to smart materials, nanoscale structures and autonomous ships. The foundations and results of this research are reflected in outstanding, contemporary education, inspiring students and PhD candidates to become socially engaged and responsible engineers and scientists. The faculty of 3mE is a dynamic and innovative faculty with an international scope and high-tech lab facilities. Research and education focus on the design, manufacture, application and modification of products, materials, processes and mechanical devices, contributing to the development and growth of a sustainable society, as well as prosperity and welfare.

Click [here](#) to go to the website of the Faculty of Mechanical, Maritime and Materials Engineering. Do you want to experience working at our faculty? This [video](#) will introduce you to some of our researchers and their work.

## Additional information

For more information about this vacancy, please contact Dr. Raf Van de Plas, [raf.vandeplas@tudelft.nl](mailto:raf.vandeplas@tudelft.nl).

For information about the application procedure, please contact Ms Hilma Bleeker, HR Advisor, [application-3me@tudelft.nl](mailto:application-3me@tudelft.nl).

Relevant publications from our lab:

- Van de Plas R. et al., Image fusion of mass spectrometry and microscopy: a multimodality paradigm for molecular tissue mapping, *Nature Methods*, vol. 12, no. 4, 2015.
- Tideman L.E.M. et al., Automated biomarker candidate discovery in imaging mass spectrometry data through spatially localized Shapley additive explanations, *Analytica Chimica Acta*, vol. 1177, 2021.
- Verbeeck, N. et al., Unsupervised Machine Learning for Exploratory Data Analysis in Imaging Mass Spectrometry., *Mass Spectrometry Reviews*, 2019.
- Cassat, J. E. et al., Integrated molecular imaging reveals tissue heterogeneity driving host-pathogen interactions., *Science Translational Medicine*, vol. 10, no. 432, 2018.
- HuBMAP Consortium, The human body at cellular resolution: the NIH Human Biomolecular Atlas Program., *Nature*, vol. 574, no. 7777, 2019.

More info: <http://vandeplaslab.tudelft.nl>.

## Application procedure

Are you interested in this vacancy? Please apply no later than September 30, 2022 via the application button and upload the following documents;

1. a detailed curriculum vitae (and a list of publications if available);
2. a letter of motivation and research interests (up to 1 page);
3. academic transcripts of all exams taken and all obtained degrees (in English);
4. names and contact information of two academic references (e.g., project/thesis supervisors);
5. a copy of research-oriented documents authored by the applicant (e.g., thesis, conference/journal publications) (max. 3).

The expected start date is as early as is practical.

A pre-employment screening can be part of the selection procedure.

You can only apply online. We will not process applications sent by email and/or post.

Acquisition in response to this vacancy is not appreciated.

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