A glimpse into the Arctic future: equipping a unique natural experiment for next-generation ecosystem research

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PhD student - Early Stage Researcher (ESR12)

Smart root imaging technology for root phenological studies

About FutureArctic

The EU-funded Innovative Training Network FutureArctic aims to quantify how much carbon will escape from the Arctic in future climate. How do the multitude of ecosystem processes, driven by plant growth, microbial activities and soil characteristics, interact to determine soil carbon storage capacity? A group of fifteen PhD-students will study the Forhot ecosystem in Iceland, where a natural coincidence has provided us with the exceptional opportunity to actually look into the future.

Given the strong urgency of tackling and managing the climate challenge and the particularly important role herein of (sub)Arctic ecosystems, a rapid assessment of the ecosystem and ambient processes in this natural laboratory is essential. FutureArctic will achieve this challenge by adopting the fast advances made in the field of **machine learning and artificial intelligence** (AI), **unmanned aerial vehicles** (UAV) and (remote) **sensor technology** into **environmental research at the ecosystem scale**, into a new concept of an '**ecosystem-of-things**'.

FutureArctic thus aims to channel an important evolution to automated machine-assisted fundamental environmental research. This is achieved through dedicated training of researchers with profiles at the inter-sectoral edge of computer science, artificial intelligence, environmental and agricultural science, sensor engineering and communication and social sciences. FutureArctic training ensures the **development of unique enviro-technological job profiles**, all with their own specialty, embedded in holistic knowledge on connected high-data throughput ecosystem research, ready for machine-assisted environmental ecosystem science and modelling.

About the host organization

Vienna Scientific Instruments GmbH (VSI) is a young and dynamic engineering start-up focusing on scientific instrumentation. Our offices and workshops are located in Alland – just outside the city boarders of amazing Vienna. As truly innovative and highly functional scientific instruments can be built only by collaborating with expert scientists and extensive R&D&I activities, VSI fully commits to the Triple Helix concept of university-industry-government relationships - illustrating the necessary shift from the Industrial Society to the Knowledge Society. VSI has currently seven full-time employees with a core expertise in mechatronics, process automation and rapid prototyping. Core products, and center of our own R&D activities, are insect rearing equipment and minirhizotron camera systems, however, we are currently also involved in several other R&D projects such as remote gas sampling with UAVs ("IsoDrone") or the development of low-cost IRGA systems ("CO2FluxI").
The PhD will be co-supervised by Boris Rewald, a co-founder of VSI, and Gernot Bodner at BOKU, and Ivika Ostonen at UTARTU. The BOKU researchers combine their expertise in (hyperspectral) imaging, plant physiology, soil science, forestry and agronomy, and root phenotyping with UTARTUs expertise in root and soil ecology to facilitate the much-needed technological advancement in root research.

Task description

Your PhD project

You will develop a permanently installed, fully automated, and remote-controllable mini-rhizotron (MR) camera system with UHD resolution to facilitate root phenological studies *in situ*. This system will be tested and validated at the ForHot field site under harsh arctic conditions. You will also identify wavebands beyond the visible spectrum allowing for enhanced segmentation (i.e. separation between roots and soil) and species-specific differentiation of three exemplary artic root systems via image analyses - using a unique hyper-spectral camera set-up for rhizoboxes. A data processing pipeline, involving machine learning tools, will be developed for automatic analysis of the gathered RGB and/or hyperspectral root signatures. Finally, strategies how to integrate multi-spectral imaging capacities in future generations of MR camera systems will be developed.

Secondments

You will embark on secondments to other FutureArctic partners (UTARTU, BOKU, IMEC, LBHI). At UTARTU you will be trained in recognizing roots and mycelia in MR images, and analysis of root phenology. At BOKU you will set-up rhizobox experiments to determine hyperspectral properties of key arctic plants and train models towards species-specific analyses of root growth dynamics – assisted by the machine-learning experts at IMEC (Steven Latré). At LBHI (Bjarni D. Sigurdsson) you will set-up field tests and learn about specific aspects of Arctic ecosystems.

Benefits of working in an ITN

- You will be working within our international group of > 25 researchers
- You will get in contact with the other members of this international consortium and will benefit from the joint training platform to develop skills necessary for developing an “ecosystem-of-things”.

Profile and requirements

- Applicants must hold a MSc or equivalent in the field of computational image analysis, data science, bioinformatics or a related discipline incl. biology.
- Applicants must have a good understanding of mechatronics and programming and foster an interest in roots and ecosystem processes. Skills in Matlab, R, CAD software and a reasonable proficiency in C/C++/Python/... are an asset.
- Applicants can be of any nationality.
- Applicants must have an ability to understand and express themselves in both written and spoken English to a level that is sufficiently high for them to derive the full benefit from the network training.
- Applicants must be eligible to enrol on a PhD programme at a designated university.

In addition:
H2020 MSCA Mobility Rule: researchers must not have resided or carried out their main activity (work, studies, etc.) in the country of the host organisation (Austria) for more than 12 months in the 3 years immediately before the recruitment date. Compulsory national service, short stays such as holidays, and time spent as part of a procedure for obtaining refugee status are not taken into account.

H2020 MSCA eligibility criteria: Early Stage Researchers (ESRs) must, at the date of recruitment by the host organisation, be in the first four years (full-time equivalent research experience) of their research careers and have not been awarded a doctoral degree. Full-Time Equivalent Research Experience is measured from the date when the researcher obtained the degree entitling him/her to embark on a doctorate (either in the country in which the degree was obtained or in the country in which the researcher is recruited, even if a doctorate was never started or envisaged).

Benefits

- You will be employed by the host organisation for 36 months.
- A competitive salary plus allowances. Moreover, funding is available for technical and personal skills training and participation in international research events.
- You will benefit from the designed training programme offered by the host organisation and the consortium.
- You will participate in international secondments to other organisations within the FutureArctic network and in outreach activities targeted at a wide audience.

Please, find additional information in the *Information package for Marie Curie fellows*

Application

Interested candidates are invited to apply for this position through the link below.
www.vienna-scientific.com/contact/vacancies/
Expected starting date: September 2019

More information and other vacant positions can be found on www.futurearctic.eu

Additional information

For additional information about the research project and this individual position, please contact:

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