Job Advertisement

DIG-IT! – “Digitalization of natural complexity for the solution of socially relevant ecological problems” – is a new research consortium at the University of Greifswald in the framework of the Excellence Research Programme of the State of Mecklenburg-Western Pomerania “Digitization in research”. For a period of 36 months, starting 01.07.2019 (26 months technical employee starting 01.11.2019) and subject to the final allocation of funds, we are seeking:

- **1 full-time researcher** (**postdoc**; remuneration according to salary group 13 TV-L Wissenschaft)
- **5 positions** as part-time research assistants (65 per cent) for the purpose of doctoral studies (**doctoral student**; remuneration according to salary group 13 TV-L Wissenschaft)
- **1 full-time technical employee** (remuneration according to salary group 9 TV-L Science)

Project background

By exploring the opportunities of digitalization for the ecological sciences, *DIG-IT!* will meet pressing ecological questions of high societal relevance with a future-oriented arsenal of methods and thereby qualify digitally competent ecologists and ecologically experienced biomathematicians and computer scientists. *Dig-It!* will address a broad array of questions including (but not limited to) service functions and stability of ecosystems under climate and land use change, species protection and innovative environmental monitoring. The overarching goal is to facilitate a "quantum leap" for the field of ecology through the development of universally applicable methods using self-learning algorithms ("Deep Convolutional Neural Networks"), because in the digital age the challenge no longer lies in the amount of available primary data, but in its evaluation. For this purpose, *DIG-IT!* will combine the developmental expertise for the automated analysis of image data (Fraunhofer Institute for Computer Graphics, Rostock and Biomathematics University Greifswald) with the application to urgent ecological questions (Botany / Landscape Ecology / Zoology University Greifswald).

The advertised positions in detail:

Postdoc: *DIG-IT!* brings together developers and ecological users of state-of-the-art machine learning techniques (DCNNs). The postdoctoral position is dedicated to scientific cohesion and integration within the *DIG-IT!* consortium. The candidate will work alongside the parallel working ecological doctoral students and fosters exchange with the methodically working doctoral students. Synergies, possible extensions and abstractions will be developed from these collaborations and specific case studies. The candidate will develop a ‘methodological toolbox’ of processes, rules, applications and algorithms, which will be made available to other scientists outside the framework of the project. An interest in the ethical and science-theoretical consequences of digitalization in the (ecological) sciences is preferred.

Contact person: wilmking@uni-greifswald.de

Doc_woodanatomy: Answering ecological and silvicultural questions with societal relevance (carbon cycle and climate change, sustainable forestry, regional climate reconstruction) requires spatially and temporally highly-resolved information on growth dynamics and stress

resistance as well as on climate sensitivity of native and non-native tree species. The candidate will establish the automated digitization of wood anatomical parameters by deep learning algorithms (in cooperation with the work packages Fraunhofer / Bioinformatics). Based on calibration studies, the application in time (climate reconstruction) and then in space (influence of management) will be tested.

Contact person: wilmking@uni-greifswald.de

Doc_roots: Answering ecological and biogeochemical questions with social relevance (carbon cycle and climate change, sustainable agriculture, erosion control) requires spatially and temporally highly resolved information on the dynamics of plant roots, which so far are only available fragmentarily. The candidate will establish the automated digitalization of the dynamics of plant root systems from minirhizotrones by deep learning algorithms (in cooperation with work package Fraunhofer IGD). Starting with strongly simplified systems on a homogeneous substrate, the complexity will gradually be increased. After successful establishment in different ecosystems, the method will be applied to a relevant case study.

Contact person: juergen.kreyling@uni-greifswald.de

Doc_pollen: Thanks to new methods, palynology is currently facing a shift towards a quantitative science. However, this change is limited by the pollen data available. Traditional, manual pollen counting is far too costly to remedy this deficiency. An automated pollen recognition system with learning algorithms is to be developed, which will initially be trained on pure samples from native trees. In two steps pollen recognition is then achieved in real samples from lake sediments and peat. At the same time, each development step offers a concrete application. Step 1 allows the determination of the pollen productivity and morphology of individual species (e.g. beech) along climatic gradients; step 2 allows the recognition of masting years of beech in annually stratified lake sediments, which in turn allows a yearly accurate combination of lake sediments and tree rings. In step 3, pollen diagrams are finally created digitally.

Contact: hans.joosten@uni-greifswald.de

Doc_mammals: For the automated inventory of native species, visual methods (e.g. camera traps) are increasingly used, especially for mammals such as bats, which are difficult to detect, nocturnal and strictly protected. At the same time, the widespread use of automatic acoustic bat detectors creates large amounts of digital data for species identification. Both methods are now standard in bat monitoring. Still missing is an automated linking and evaluation of these digital data. The candidate will develop an automated digitalization of image and audio data as an example of image and call files of bats flying in/out of hibernacula in order to achieve automated monitoring of bat populations in the future. The established method is to be tested exemplarily on other relevant animal species (e.g. otters).

Contact: gerald.kerth@uni-greifswald.de

Doc_biomath: In the digitisation of ecological image data, graphs play a fundamental role. Particularly in the root subproject, to which this PhD position is mainly dedicated, graphs are needed as a model for roots. Most often the graphs representing the root structure are graph theoretical trees, but sometimes also networks occur. The mathematical properties of these

graphs, for instance their balance, shall be analysed using various indices. For the investigation of different root types even new balance indices will have to be developed (e.g. in order to assess the 3-D structure, as the existing balance indices are only suitable for 2-D-trees). Thus, this project offers ideal perspectives for a mathematically oriented PhD student to develop new mathematical models for ecology. The ecological aim of this subproject is gaining understanding of the distribution of nutrients in the soil, as this distribution has an impact on the root growth which can be analysed thanks to the temporal course of the digitised recordings. For the position, mathematical pre-knowledge, particularly in the area of graph theory, is essential. It is beneficial if the candidate is also fluent in at least one programming language. Ecological and biological pre-knowledge is also beneficial, but not mandatory. However, willingness to cooperate interdisciplinarily is essential.

Contact person: mareike.fischer@uni-greifswald.de

Technician: A technician supports all subprojects, e.g. with drill core removal and thin cutting of trees, rhizotron scanning for root detection, collection of pollen samples, installation and selection of photo traps in wildlife monitoring, as well as database administration.

Contact person: wilmking@uni-greifswald.de

Hiring requirements:

We are looking for highly motivated candidates with above-average qualifications, enthusiasm for, and experience in research as well as the willingness to actively participate in the joint project.

Successful candidates for doctoral positions have:

- an M.Sc. degree (or comparable university degree) in biology, landscape ecology, computer science, biomathematics or another relevant subject,

- solid knowledge in ecology and evolutionary biology,

- Experience with methods and/or organisms relevant to the position,

- excellent written and spoken English (all courses are held in English)

- Motivation to participate in an interdisciplinary research and teaching environment.

A driver's license for passenger cars is an advantage, as is knowledge of German or the willingness to learn German.

The **postdoctoral position** in addition also requires a doctorate or comparable international degree in a discipline relevant to the consortium, international publication activities, excellent communication skills and excellent knowledge of German and English.

Experience in image processing, database management, and technical support of ecological field research is desired for the **technician position**.

The University would like to increase the proportion of women in areas in which they are underrepresented and thus applications from women are particularly welcome and will be treated with priority if they have the same qualifications and as long as there are no clear reasons which make a fellow applicant more suitable. Preference will be given to severely disabled applicants if they can provide equal qualifications. This call is addressed to all persons irrespective of their gender. Unfortunately, the application costs will not be reimbursed by the state of Mecklenburg-Vorpommern. **You can find the legally binding text of the job advertisement at www.uni-greifswald.de** (only in German).
Applications comprising the common set of documents (curriculum vitae, copies of academic certificates, list of publications) should be sent by **April 14th, 2019**, in electronic form (one pdf-file) by email, to the relevant contact person listed above for each position.

For more details, please contact Prof. Dr. Martin Wilmking, +49 3834 420 4095 (direct line) wilmking@uni-greifswald.de.