UNIVERSITÄT BIELEFELD

The Technical Faculty offers two full-time

# research positions

starting September 1st, 2021

(E13 TV-L, non-permanent positions)

## Your Tasks

ALPACA is an EU-funded international training network (ITN) that deals with the design and implementation of algorithms in the field of computer-aided pangenomics (“computational pangenomics”). Genomes can be understood as sequences ("words") over the letters A, C, G and T, the alphabet of nucleotides. These words encode the program of the respective organism or pathogen (viruses, bacteria, plants, mammals). Genomes of the same species differ only in a few places. This allows large amounts of similar genomes (e.g. those of all humans, or all coronaviruses, etc.) to be treated efficiently as graphs and not as a set of sequences. The underlying graphic models have only recently become the subject of research. The compression, the design of efficient algorithms for processing, and artificial intelligence methods for evaluating the pangenome graphs are all still in their infancy. The research direction has great potential, since naive approaches to treat and evaluate large amounts of related genomes are hardly effective. The aim of the ITN is firstly to systematically research the graphic models, and secondly to provide comprehensive training programs to enable the training of a new generation of researchers with great future potential. At Bielefeld University, the following questions will be dealt as part of this project:

1. Development of pangenome graph based feature spaces for the application of deep learning. Although possessing universal power in theory, deep learning has so far not been studied for the analysis of genomes very thoroughly. Pangenome graphs give rise to intriguing feature spaces that represent large collections of individual genomes. As a consequence, deep learning can be applied for detecting prevalence for diseases in humans and for virulence and resistance to medical treatment of pathogens, such as viruses (e.g. Corona) and bacteria (e.g. from the gut microbiome).

2. Development of methods for the comparison of two or more pangenomes represented in form of graphs. Based on simple structural properties of the graphs, of attributes of the sequences contained, or of its functional content, alignment-free measures for pangenome similarity or distance shall be developed. These measures will be implemented, tested and exemplarily applied to pangenomic data. The result will be a software tool for quantitative pangenome comparison.

The corresponding research activities will relate to either the field of Computational Pan-Genomics or Artificial Intelligence in Biomedicine. Particular examples of potential research are:

- creation and analysis of novel algorithmic/mathematical structures and indexes that support the mapping of the genetic diversity of entire populations
- creation and implementation of programming frameworks that support the analysis of the genetic diversity of diseases
- development and design of pan-genome representations for deep learning analysis
- development and design of deep neural network architectures for the analysis of ‘multi-omics’ datasets
- construction of deep network architectures to derive predictions from those representations

The exact choice of topic can be determined in personal discussions, according to personal preferences and strengths.

The third-party funder requires the following: Applicants may have spent a maximum of 12 months in Germany in the past three years.

## Your Profile

**We expect**
- completed relevant academic university degree (e. g. master) in computer science, bioinformatics or mathematics
- good knowledge of the English language (written and oral)
- strong communication skills, independent, style of work and high individual initiative
- pursuit of a doctorate

**Preferable qualifications**
- experience in the development and analysis of methods of bioinformatic data analysis
- experience with the implementation of efficient algorithms for the analysis of bioinformatic high throughput data
- current publication activity

Due to the project requirements, the applicant must not have a PhD or have worked in research for more than four years after graduation.

## Remuneration

Salary will be paid according to Remuneration level 13 of the Wage Agreement for Public Service in the Federal States (TV-L). As stipulated in § 2 (1) sentence 1 of the WissZeitVG (fixed-term employment), the contracts will end after three years. In accordance with the provisions of the WissZeitVG and the Agreement on Satisfactory Conditions of Employment, the length of contract may differ in individual cases. The employment is designed to encourage further academic qualification. In principle, the two full-time positions may be changed into a part-time positions, as long as this does not conflict with official needs.

Bielefeld University is particularly committed to equal opportunities and the career development of its employees. It offers attractive internal and external training and further training programmes. Employees have the opportunity to use a variety of health, counselling, and prevention programmes. Bielefeld University places great importance on a work-family balance for all its employees.

**Application Procedure**
For full consideration, your application should be received via either post (see postal address below) or email (a single PDF document) sent to aschoenhuth@cebitec.uni-bielefeld.de by **January 31st, 2021**. Please mark your application with the identification code: **wiss20288**. Please do not use application portfolios and send only photocopies of original documents because all application materials will be destroyed at the end of the selection procedure. Further information on Bielefeld University can be found on our homepage at www.uni-bielefeld.de. Please note that the possibility of privacy breaches and unauthorized access by third parties cannot be excluded when communicating via unencrypted e-mail. Information on the processing of personal data is available https://www.uni-bielefeld.de/Universitaet/Aktuelles/Stellenausschreibungen/2019_DS-Hinweise_englisch.pdf.

**Postal Address**
Universität Bielefeld
Technische Fakultät
AG Genome Data Science
Herrn Prof. Dr. Alexander Schönhuth
P.O. Box: 10 01 31
33501 Bielefeld
Germany

**Contact**
Name: Prof. Dr. Alexander Schönhuth
Phone: +49 521 106-3362
Email: aschoen@cebitec.uni-bielefeld.de

**Contact**
Name: Prof. Dr. Jens Stoye
Phone: +49 521 106-3852
jens.stoye@uni-bielefeld.de