Vocational Training Project in Bioinformatics @ BiRC

A Vocational Training Project in Bioinformatics (VTPiB) is a 5 or 10 ECTS project related to the research at BiRC. The project work is carried out in consultation with a project supervisor at BiRC, and is documented in a written report and at an oral exam. If you are interested in doing a VTPiB, you should start by contacting a potential supervisor at BiRC.

Signing up for a project: You sign up for a VTPiB in the same manner as you sign up for a regular class, i.e. during the first week of November, if you are doing a project in the Spring, or during the first week of May, if you are doing a project in the Fall. When you sign up, you can choose between different versions of VTPiB. This reflects whether the VTPiB that you are signing up for is the 1st, 2nd, or 3rd VTPiB in your Study Program.

Working in a group: You can do a VTPiB in a group of up to three students. Each group member must sign up for the VTPiB individually cf. above and each group member must make an individual contract cf. below (note in the contract that you are working in a group, and list your group members). The group hands in a single combined report and each group member has an individual oral exam cf. below.

Project contract: After you have signed up for a VTPiB, you must make a project contract in coordination with your supervisor. As part of the project contract, you must attach a pdf-document describing the problem statement, activity plan, and supervision plan for you project, i.e. fill out the information and paragraphs on the next page, and attach it to your contract.

The project contract, including attachment, must be submitted via https://kontrakt.nattech.au.dk/ before **September 1**, if the project is done in the Fall semester, and **February 1**, if the project is done in the Spring semester. Note that you in the project contract must agree on a **submission date** in the exam period immediately following the project work. The submission must be chosen such that it is possible to do the exam in the same exam period. Typical submission dates are January 15, if the project is done in the Fall semester, and June 15, if the project is done in the Spring semester.

Project work: When a project contract has been submitted, and approved, it is your responsibility, under supervision, to do the described project, and hand in the report (10-15 pages, if a 5 ECTS project, and 20-25 pages, if a 10 ECTS project) via Digital Exam no later than the agreed submission date. If you are working in a group, the volume of the work and report must reflect this.

Exam: The exam is a 15 min presentation of the project, followed by a 15 min discussion of the presentation and the report. Besides the supervisor, an internal co-examiner (another BiRC researcher) must be present at the exam. The final grade is based on an overall assessment of the written report, the presentation, and the following the discussion, where the assessment of written report contributes the most. If you are working in a group, all group members have individual exams.

Supervisor responsibility: It is the responsibility of the supervisor to conduct the exam during the exam period immediately following the project period, and plan accordingly with the student(s) and internal examiner. The supervisor must submit name of the internal examiner to Christian Storm Pedersen (cstorm@birc.au.dk) before **December 1**, if the project is done in the Fall semester, and **May 1**, if the project is done in the Spring semester. The supervisor and internal examiner get the project report via Digital Exam, and must submit the final grade via Digital Exam.

See http://birc.au.dk/studies/vtpib/ for more information.

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Group members	Esther Helga Klemenzardóttir, Anders Lydig Kristensen
Supervisor	Juraj Bergman
Company Name	Teknologisk Institut
Company Supervisor	Mikkel Bue Lykkegaard
Project title	Data-Driven Derivation of Crop Vulnerability Curves in Climarisc
Start date	September 1 (for Fall projects) / February 1 (for Spring projects)
Submission date	January 15 (for Fall projects) / June 15 (for Spring projects)

Problem statement / project description:

5-7 lines describing the overall aim of the project. Make it clear what the objectives are, e.g. analyse data sets, implement an algorithm, develop or use theory. Remember that the project should be doable in 14 weeks (~275 hours of work, including the final exam), and that it should be possible to document it in a report of 20-25 pages. If you are working in a group, the volume of the work and report must reflect this. **Think of the text as how you would explain your project and its objectives to others.**

This project will derive and analyze crop vulnerability curves, which describe how crop yields respond to climate stressors such as drought. Using the global gridded yield dataset from Iizumi et al. (2019) together with additional publicly available covariate data (e.g. soil type, landscape, orientation), the project will explore how environmental factors and, where possible, management practices influence these vulnerability functions. The work will involve exploratory data analysis, stratification by key variables, and estimation of dose–response relationships between stressors and yields. A focus will be placed on comparing statistical associations with causal interpretations, providing insights into real-world crop–climate vulnerabilities. The outcome will be a data-driven assessment of how different factors shape crop responses under climate extremes.

Problem statement / project goals:

A brief and clear presentation of what the student should be able do to after the project formulated as 4-5 project goals:
- The student should be able to describe ...
- The student should be able to implement …
- The student should be able to analyse ...
- The student should be able to discuss ...

Example of general project goals that could be made project specific by naming concrete methods and experiments:
- The student should be able to describe the project background and the theoretical basis of the used methods.
- The student should be able to implement relevant methods and/or experiments.
- The student should be able to analyse the implemented methods and performed experiments.
- The student should be able to discuss and visualize the findings in the project.
- The student should be able to discuss future perspectives of the project.

Example of project specific goals:
- The student should be able to explain how a De Bruijn Graph based assembler work.
- The student should be able to implement the BW transformation in Python.
- The student should be able to analyse the running time of the algorithm implemented for suffix array construction.
- The student should be able to identify cancer driver genes.
- The student should be able to discuss fairness in neural network algorithms.

Think of these items as what you and your project will be evaluated by at the exam.

- The student should be able to describe the background of crop–climate vulnerabilities and the theoretical basis for deriving vulnerability curves from observational yield data.
- The student should be able to implement data processing and exploratory analyses using the Iizumi et al. (2019) dataset together with relevant covariates (e.g., FAOSTAT, soil and environmental data, and management data where available).
- The student should be able to analyse crop vulnerability curves by stratifying data along key environmental variables and, where possible, management variables.
- The student should be able to discuss the interpretation of vulnerability curves and reflect on their implications for understanding crop–climate relationships.
- The student should be able to visualize and communicate the derived results in a scientifically clear and reproducible way.

Activity plan:

A few lines describing the overall the timeline of your project activities, for example formulated bi-weekly milestones. **Think of the text as how you plan to do the project outline in the problem statement.**

Week 1-2: Reading papers and getting data.
…
Week 13-14: Finalize project report and submit on time.

September: Project familiarization, data acquisition, discussion of analysis plan, set up coding environment**.**
October: Exploratory data analysis, initial modeling of main approaches.
November: Refinement of methods, continued analysis, regular progress evaluation, interim presentation/discussion.
December: Final analyses, preparation of results and deliverables, concluding supervision meeting and reflection.

Supervision plan:

A few lines describing the overall structure of your supervision and collaboration with the company as agreed upon together with your supervisor and company supervisor, e.g. “We plan bi-weekly meetings of ~45 minutes. Specific questions to be addressed at the meeting must be e-mailed to the supervisor at least a day before the meeting in order to give proper time for preparation. I plan to be at the company site 1 day per week”. **Think of the text as an alignment of expectations between you and your supervisors.**

We plan weekly supervision meetings of approximately one hour, where the main supervisor will provide support on project management, scientific direction, and technical troubleshooting. Meetings will include updates on progress, discussion of challenges, and planning of next steps, as well as support for data access, code review, and interpretation of results. All communication and documentation will be in English. Additional coordination with institutional contacts (e.g., BiRC) will be arranged if needed.