INCIDE – IT solutions in the life sciences

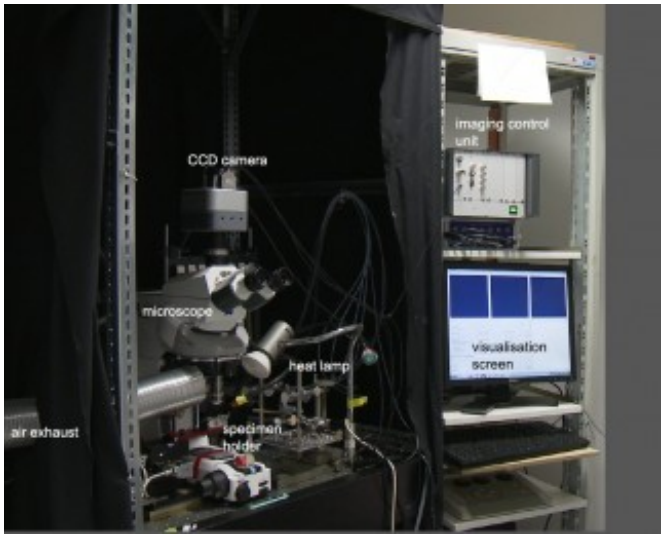
The use of modern research methods in the natural sciences generates increasing amounts of data, which can often only be analysed using special software. The INCIDE research centre at the University of Konstanz provides data processing services that facilitate the development and adaptation of software programmes for use in the life sciences. The INCIDE scientists work in close collaboration with life scientists. In future, this successful concept will also be used for external projects.

Prof. Dr. Oliver Deussen is the head of the INCIDE research centre at the University of Konstanz. © private

Image analyses, high-throughput screening (HTS) and the sequencing of human and other genomes creates huge amounts of data, which cannot be handled without the use of specific data processing programmes. In order to find the proverbial needle in the haystack, IT experts are constantly developing new programmes and methods to support life scientists in their work. This is what the INCIDE research centre at the University of Konstanz does. The "Interdisciplinary Center for Interactive Data Analysis, Modelling and Visual Exploration" develops methods that enable the processing and visualisation of highly complex scientific data repositories. Amongst other departments and groups, the centre links the Department of Computer Science and Information Science, the Graduate School Chemical Biology, the Department of Mathematics and Statistics and the Explorative Analysis and Visualisation of Large Information Spaces research training group.

The partners tailor solutions to a broad range of research issues. It is a mutually beneficial situation for all partners involved – scientists on the one hand and biologists and chemists on the other – in that the scientists gain access to completely new data analysis possibilities and experimental approaches and the computer scientists gain many new insights. "The development of software for specific life sciences issues always gives us ideas for new research in the field of data visualisation," says the research centre's director, Prof. Dr. Oliver Deussen. The success of the interdisciplinary approach at INCIDE can also be quantified: more than 30 projects have already been carried out and have led to 12 publications.

Support for a broad range of scientific issues



Experimental set-up used to analyse olfactory processes in bees. © Prof. Giovanni Galizia, University of Konstanz

"It is usually the scientists who contact us to tell us about their research plans and we try to understand the issue as best we can. This obviously requires us to have comprehensive knowledge of biology and chemistry," said Deussen. The computer scientists then assess the time and kind of support the life scientists require. Support can be on different levels:

Basic support is provided to solve problems that can be approached using well-established software tools. The INCIDE team provides advice and help in using software packages. There is also what they call mid-level support, designed to solve more elaborate problems that do not easily fit into standard approaches, but that can for example be solved by modifying a software

package. "For example, we can adapt a standard image analysis method which then enables the evaluation or identification of specific cell differentiation stages," explains Deussen. In this case, the INCIDE team modifies or creates plugins for software packages with already known algorithms in order to adapt the software to the requirements of the issues to be solved.

High-level support is provided for problems that cannot be solved using standard approaches or standard software. This usually requires the computer scientists to develop new methods and software. One particular project that required high-level support from the INCIDE team was the development and programming of a highly efficient image analysis method for the classification of neuronal reactions associated with the olfactory processes of bees. "The newly developed programme meant that the scientist carrying out the experiment was able to control it interactively, enabling him or her to see how a bee is thinking," explains Deussen. However, it is not always possible to specifically categorise a particular research issue. "We deal more with a development process aimed at finding the right solution," added the computer scientist highlighting the way he and his colleagues approach a given task.

Cooperation and exchange as the keys to success

Software developed by the INCIDE team is also provided as open source software and integrated into platforms such as KNIME, which was also developed by Konstanz computer scientists a couple of years ago. Public access to these platforms enables wide access to the software and ensures its sustainable use. Open source INCIDE platforms enable for example the analysis of image sequences where objects such as cells need to be identified. "We have also programmed specialised applications that facilitate the analysis of cell biology data generated by laboratory robots. These applications facilitate the classification and evaluation of cell culture reaction types," Deussen adds.

The INCIDE team has already established valuable collaborations with research centres in the fields of biology and informatics, including the Bioimaging Center (BIC) at the University of Konstanz. "We offer data analysis services for life sciences researchers from the University of Konstanz, but also for researchers from other institutions in Germany and around the world. Naturally, the INCIDE also provides support to local companies and research partners.

The INCIDE research centre was established in 2009 as part of the "Model Konstanz – Towards a Culture of Creativity" future concept that is funded under the Excellence Initiative of the German federal and state governments. It will be funded by the German Research Foundation (DFG) until 2015. Until then, INCIDE will continue working on intensifying cooperation and expanding its services as well as developing a concept for the long-term funding of the centre.

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