# Analysing diseases through interactive visual interfaces

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Alzheimer's disease and cancer are two examples of diseases that are related to malfunctioning cellular patterns. The examination of cell tissue, however, takes a lot of time and generates a lot of data. To make

the analysis of data easier, Antonios Somarakis of the Data Science Research Programme (DSRP) and his colleagues of the Leiden University Medical Centre (LUMC) have developed a new interactive tool: the Visual Cohort Comparison tool.

## Interactively exploring the disease

"Users can continue the analysis easily and compare cohorts of samples with distinct clinical characteristics," explains Somarakis. "With ImaCytE, a tool we developed earlier, the user could identify unique cell types in a cohort of images and explore the cellular patterns they form. Now, the new tool offers users the possibility to compare different types of tissue, such as healthy and diseased tissue. The data of the image can be turned into plots, enabling the user to interactively compare cohorts based on their cell type abundance, their spatial patterns and locate those in the tissue. This will make it possible to immediately recognize differences between tissue." Using different plots, the relations to and interactions with other cells can be examined, which can bring new insights in for example the development of a disease.

## The tool at work

The new tool has already proven to work in tumor research and research in Alzheimer's disease. In tumor research, it led one of the experts testing the tool to a new insight on the spatial relations between tumors and T-cells, which are produced by the immune system to fight the tumor. Combining the plots of T-cells and the tumor cells showed that one tumor type interacts with the T-cells, whereas the other type does not interact with them. In research on Alzheimer's Disease, the raincloud plots the tool produced helped to verify the hypothesis that the amount of the immune cells of the brain differ between people with the disease and healthy people. These results show that the new Visual Cohort

Comparison tool can contribute to new insights in diseases such as cancer and Alzheimer's disease and can help to find a better way of treating the disease.

## ImaCytE

The new Visual Cohort Comparison tool is a continuation of an interactive visual analysis tool that Somarakis and his colleagues developed earlier: ImaCytE. Both tools make use of Imaging Mass Cytometry data acquisition. ImaCytE's most important task was to enable the exploration of the spatial patterns cell types form in different tissue samples. This also has been the basis of the new tool. Furthermore, ImaCytE allowed users to control the quality of the samples, in order to select the most suitable samples for their research, and to identify different cell types in the sample, so they could select the cell types they wanted to study. The disadvantage of the tool was, however, that only a few samples could be studied at once. The new Visual Cohort Comparison tool solves that and has a lot of potential to finding new insights in diseases and improving treatment selection.

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