CellExpress

On-demand Web-based Cell Microscopy Image Analysis

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Problem

Biologists pursuing commercial research need to quantify cell microscopy images. Tools such as Cell Profiler are usually used for such purposes. Unfortunately, not all biologists have time or informatics backgrounds to learn using complex software. Additionally, users in commercial settings will have to overcome more hurdles besides knowledge: installation, reliable running and scaling performance of such software for large datasets can be difficult issues to manage. And finally, audit requirements can be difficult on biologists to manage, such as that to be able to rerun the same analysis at a future point in time.

In this situation, biologists can still outsource the analysis to an external vendor with cell microscopy expertise. However, the disconnected nature of outsourcing projects prevents the biologist from later changing minor aspects such as detection thresholds, or even just re-running the analysis on a new plate without the involvement of the external vendor. However, the biologist would like to be in a position where they can re-run a given experiment any time with new data, or even make minor changes, and all of this without having to worry about the details of installing the Cell Profiler software.

Solution

CellExpress is a web-based platform that allows biologists with no informatics knowledge to simply quantify cell microscopy images, by providing an easy way of re-using old projects, outsourcing new analysis needs, and adjusting biologically adequate parameters in a user friendly manner.

CellExpress takes care of all the issues involving installation and running of Cell Profiler, running it at multiple frozen software versions, and even automatically running many copies in parallel in a cloud environment for larger datasets. With CellExpress, users access a simple web page that can retrieve their images from connected data storage. Users can then make image samples available to internal or external experts via the web page. When the expert has finalized an analysis configuration, they can register it with CellExpress. Users can then independently run the analysis on the original dataset or any other dataset, at their own pace and without requiring the involvement of the expert unless they are looking for substantial changes. Additionally, users can adjust parameters specifically enabled by the experts as adequate for the project. This is done through CellExpress' sleek user interface with auto-adjusting statistical charts, and options for exporting data and visuals for slide decks. CellExpress automatically handles running the analysis in the cloud, and freezing the software and data version used for a project. So in an audit situation, it's possible to reproduce an analysis using the exact same software version of Cell Profiler as originally used.
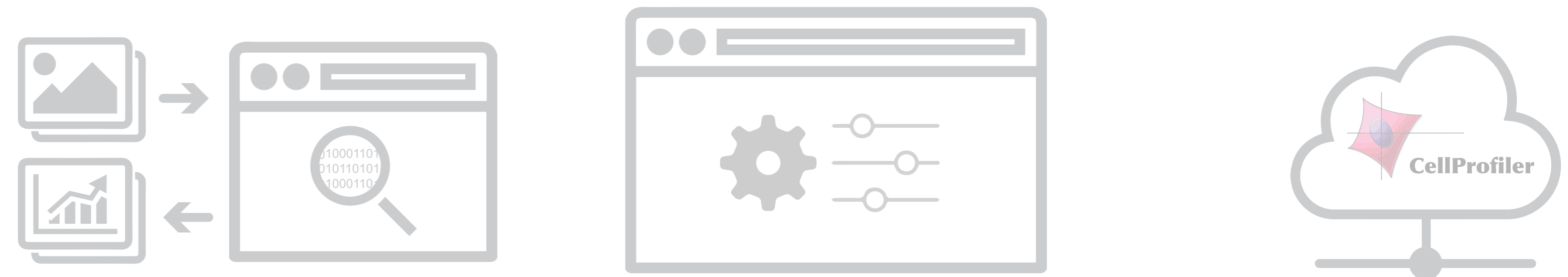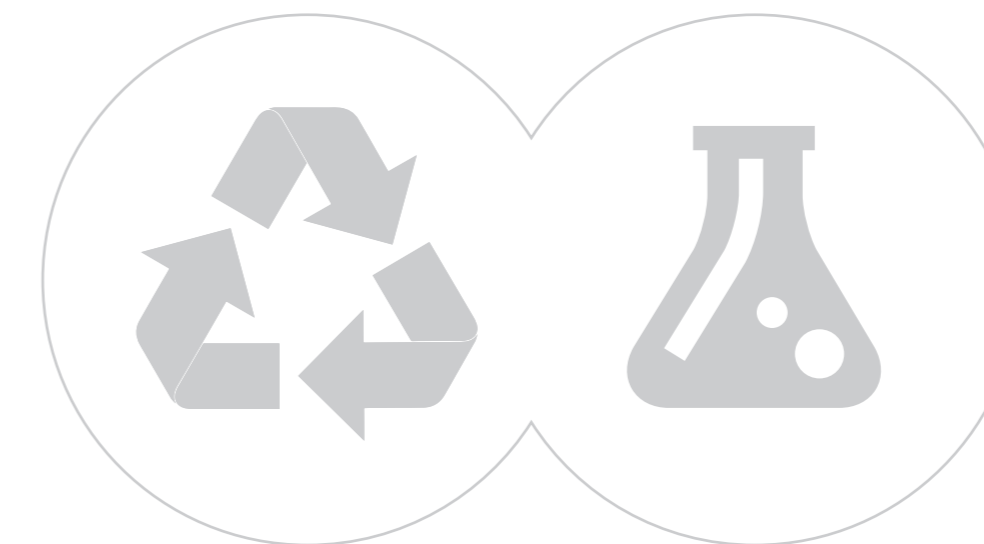
100% browser experience
portable access on phones and tables for presentations

adjustable analysis parameters
allows division of work: Informatician develops pipeline, biologist adjusts.
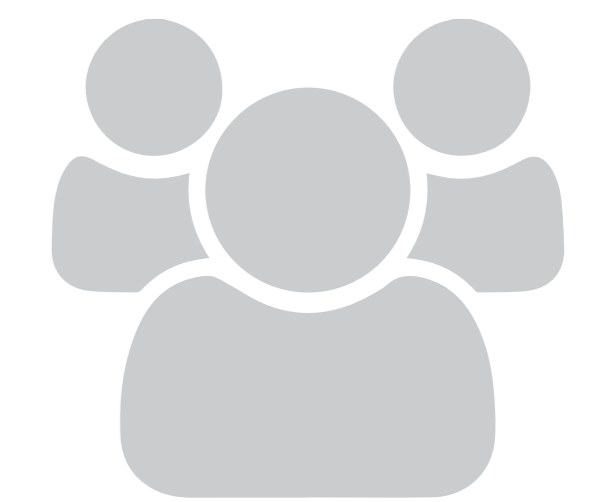
robust analysis backend
Amazon, or internal SciComp UGE cluster

integrates existing storage
integration with custom client backends

reproducible research
stores CellProfiler cppipe conf and analysis parameters

in-house/outsourced development
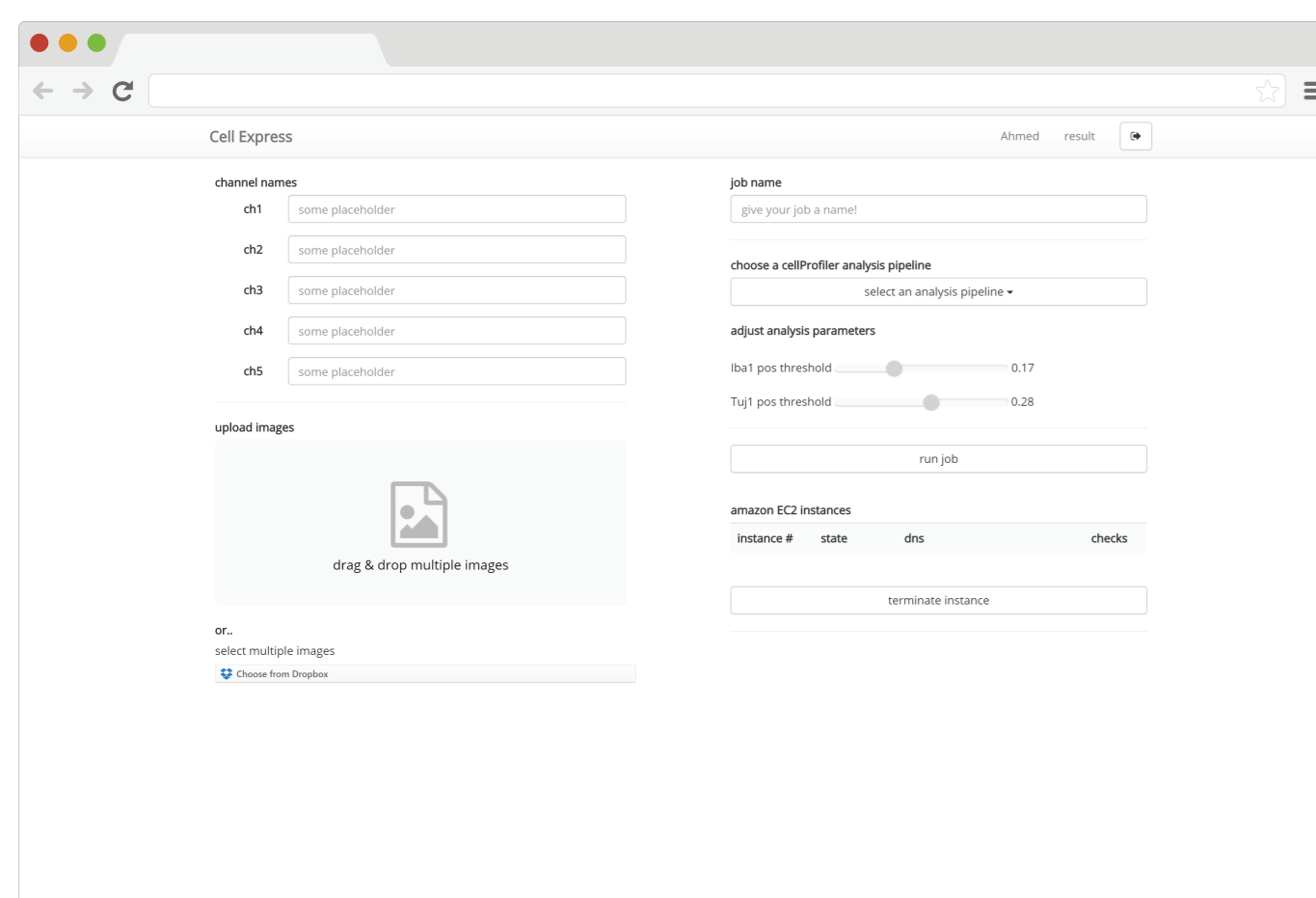separation of concerns allows in-sourcing and outsourcing
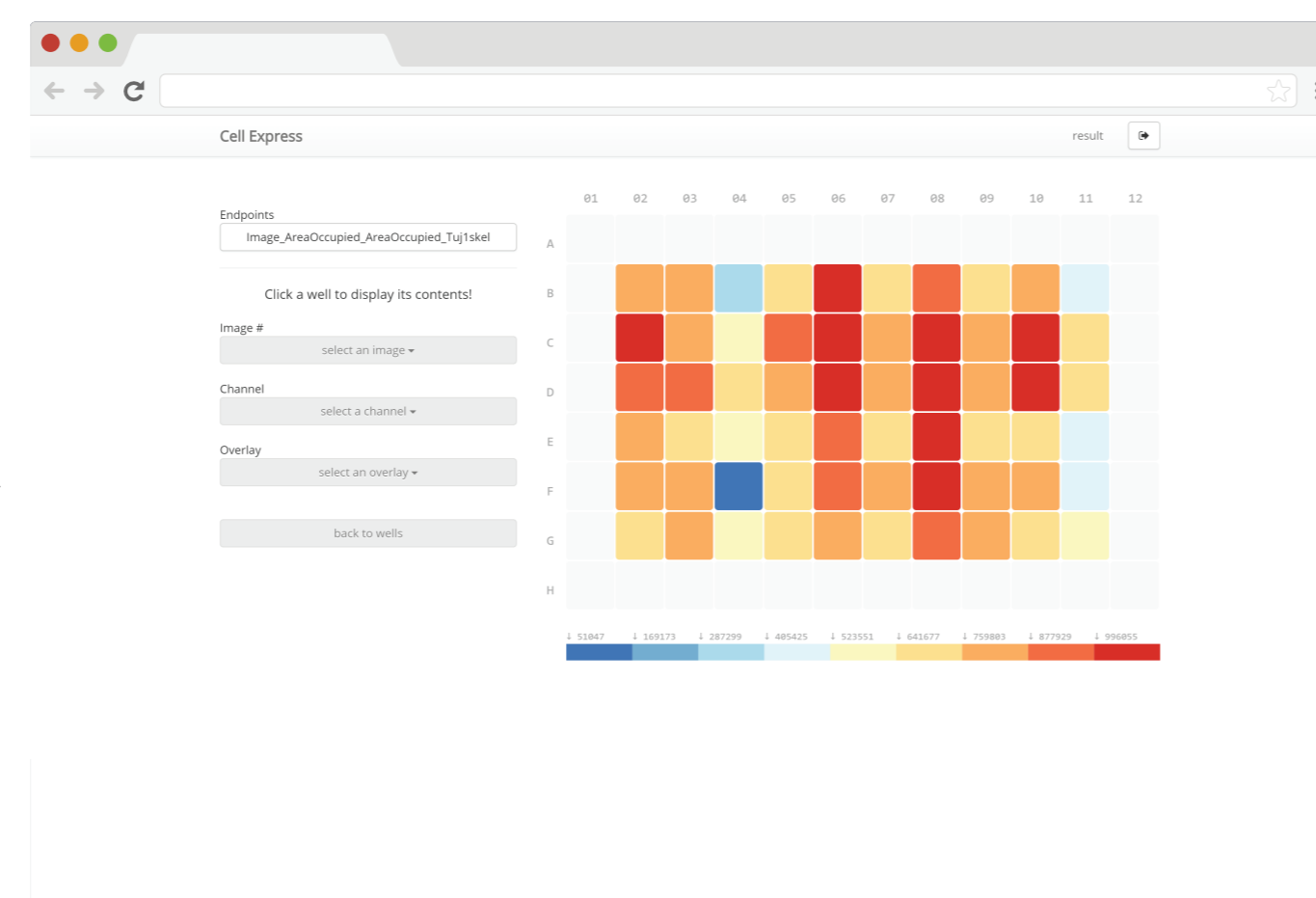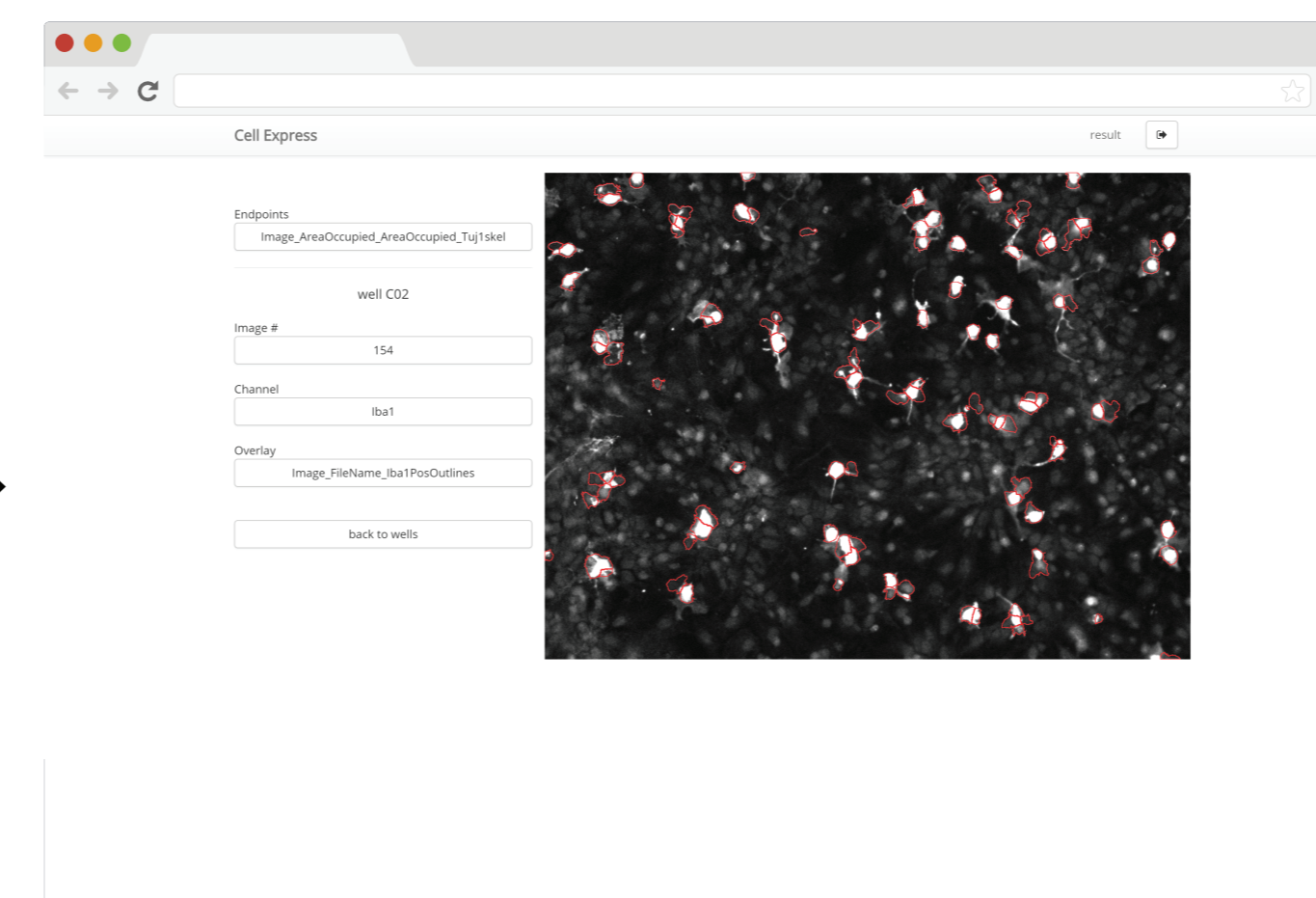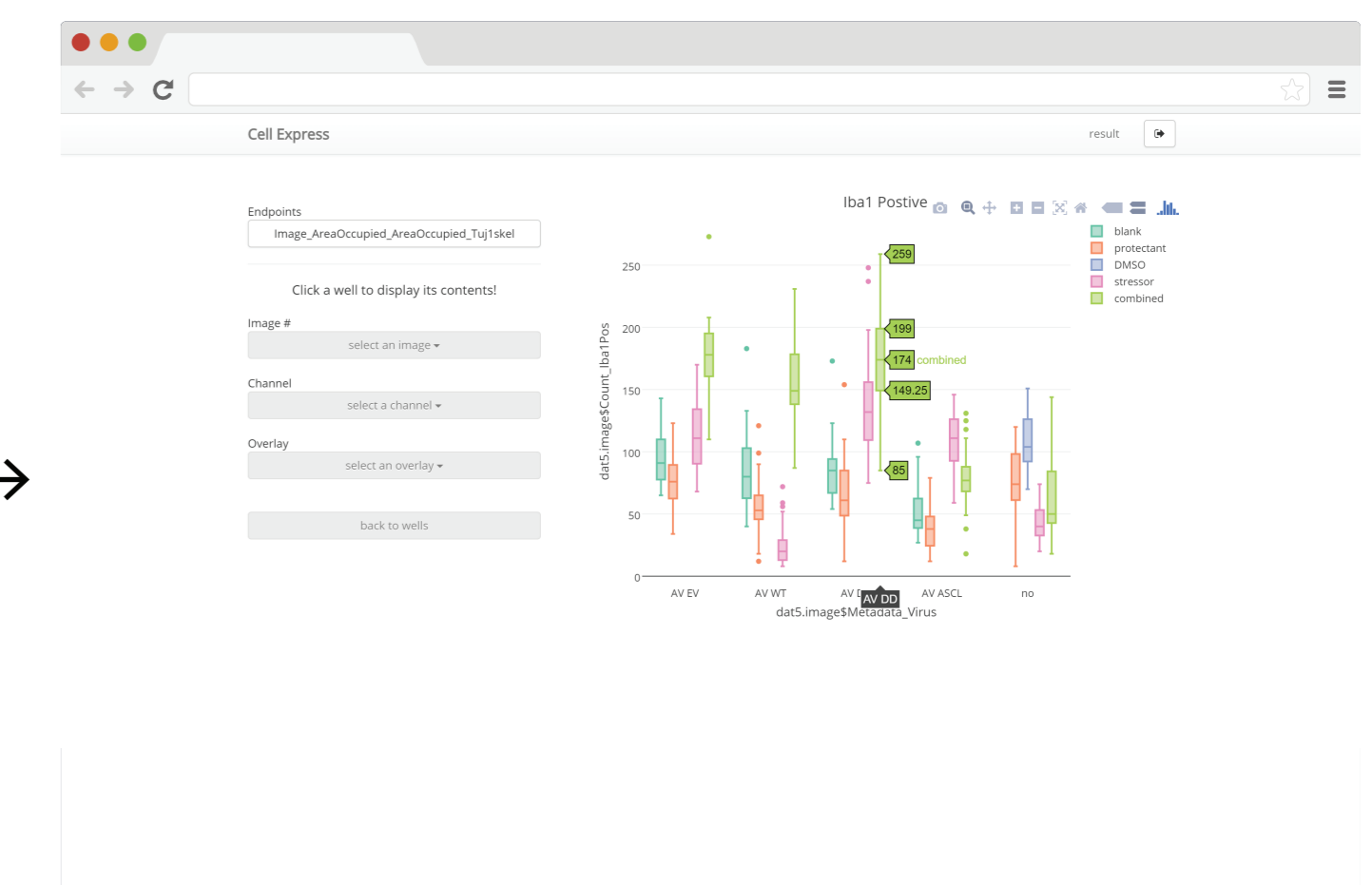
plate definition, analysis parameters setup and job submission

display plate-wide results using multiple aggregation methods

display original images with result overlays

plot variables and prepare ppt slides in the browser