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Label-free identification of subcellular organelles in human cancer cells

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Coherent Anti-Stokes Raman Scattering (CARS) is an emerging spectroscopic tool for label-free imaging of cells and tissues, due to its advantages over spontaneous Raman. Here, we present CARS measurements of MIA PaCa-2 pancreatic cancer cells. These hyperspectral data was evaluated via an unsupervised classifier, hierarchical cluster analysis (HCA), and compared the results to immunofluorescence staining of the same cells. This proved the capability of CARS for the identification of cellular structures.

In the next step we utilized this comparison to train a supervised learning algorithm, Random Forest, which after the training phase was able to automatically, simultaneously and label-free identify subcellular components like nucleus, nucleolus, lipid droplets, and endoplasmic reticulum. Furthermore, this classifier was also able to identify components of other human cancer cells lines and was successfully applied to living cells.

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