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RESEARCH AREA

In the recent decades it became achievable to obtain better and better quality multichannel, multidimensional images of tissues and cells even on the subcellular or protein levels thanks to the advanced microscopy techniques. With the advancement of high-throughput methods generating hundreds or thousand images from a single sample is no longer a dream. This not only pushes the limits of data storage capacity, but also encourages researchers to develop newer and newer image analysis methods, as the goal is to interpret data as quickly and efficiently as possible with minimal amount of human intervention. With the rise of automation, we can answer questions we never could before: which is the most promising drug candidate, which proteins play a role in complex processes such as cell division or tumor formation. The research of our group focuses on how we can help answer biological questions by efficiently analyzing thousands of microscopic images using intelligent computational algorithms with applying state-of-the-art machine learning techniques. We pay particular attention to the analysis of individual cells to identify morphological features using imaging information that allows for the discovery of previously hidden phenotypes.

TECHNIQUES AVAILABLE IN THE LAB

Our group (BIOMAG) offers the possibility to learn the following techniques: high-throughput fluorescence and confocal microscopy, light-sheet microscopy, laser microdissection, various image analysis and machine learning methods with the necessary software and hardware background, statistical analysis of results, access to the software developed by the group. In addition, it is possible to learn about different sample preparation techniques: cell culturing, immunostaining, tissue preparation and staining.

SELECTED PUBLICATIONS

Grexa, I., Iván, Z.Z., Migh, E., Kovács, F., Bolck, H.A., Zheng, X., Mund, A., Moshkov, N., **Miczán, V.**, Koos, K., Horvath, P. (2024) SuperCUT, an unsupervised multimodal image registration with deep learning for biomedical microscopy. **Brief Bioinform 25**(2): bbae029.

Barti, B., Dudok, B., Kenesei, K., Zöldi, M., **Miczán, V.**, Balla, G.Y., Zala, D., Tasso, M., Sagheddu, C., Kisfali, M., Tóth, B., Ledri, M., Vizi, E.S., Melis, M., Barna, L., Lenkei, Z., Soltész, I., Katona, I. (2024) Presynaptic nanoscale components of retrograde synaptic signaling. **Sci Adv 10**(22): eado0077.

Miczán, V., Kelemen, K., Glavinics, J.R., László, Z.I., Barti, B., Kenesei, K., Kisfali, M., Katona, I. (2021) NECAB1 and NECAB2 are consensus calcium-binding proteins of the CB1 -positive interneuron population in the mouse forebrain. **Cereb Cortex 31**(3): 1786.

László*, Z.I., Lele*, Z., Zöldi, M., **Miczán, V.**, Mógor, F., Simon, G.M., Mackie, K., Kacskovics, I., Cravatt, B.F., Katona, I. (2020) ABHD4-dependent developmental anoikis safeguards the embryonic brain. **Nat Commun 11**(1): 1.

Frau, R., **Miczán, V.**, Traccis, F., Aroni, S., Pongor, C.I., Saba, P., Serra, V., Sagheddu, C., Fanni, S., Congiu, M., Devoto, P., Cheer, J.F., Katona, I., Melis, M. (2019) Prenatal THC exposure produces a hyperdopaminergic phenotype rescued by pregnenolone. **Nat Neurosci 22**(12): 1975-1985.