BCL5

5th Workshop on Brain, Computation, and Learning

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04 July | 14:00 – 15:30
Faculty Hall

Letting dogs teach AI the scent of cancer

Abstract: Militaries around the world rely on dogs to sniff out the scent of explosives. Multiple decades of peer-reviewed literature suggests that diseases also have a scent, consisting of changes in the odor-print of the volatile organic compound (VOC) profile. The past two decades have shown that dogs can be trained to detect this scent too, allowing for the accurate detection of diseases like cancer. Yet artificial intelligence struggles with odors, which resist simple parameterization like wavelength or frequency. Odor percepts arise from a combinatorial encoding of molecules by olfactory receptors, and the complexity of this relationship is exemplified by Sell's triplets, where structurally similar molecules produce dissimilar percepts, and vice versa. This challenge underpins the limitations of current machine olfaction models, such as gas sensors for cancer detection, which fail to generalize reliably. We propose a percept-first approach: trained biomedical detection dogs, wearing EEG-based BCIs, can serve as perceptual labelers, providing high-dimensional neurobehavioral data to reverse-engineer molecular patterns and transform machine olfaction.