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NEUROCOGNITIVE COMPUTING LAB

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Novelty detection by density estimation in the fruit fly olfactory circuit

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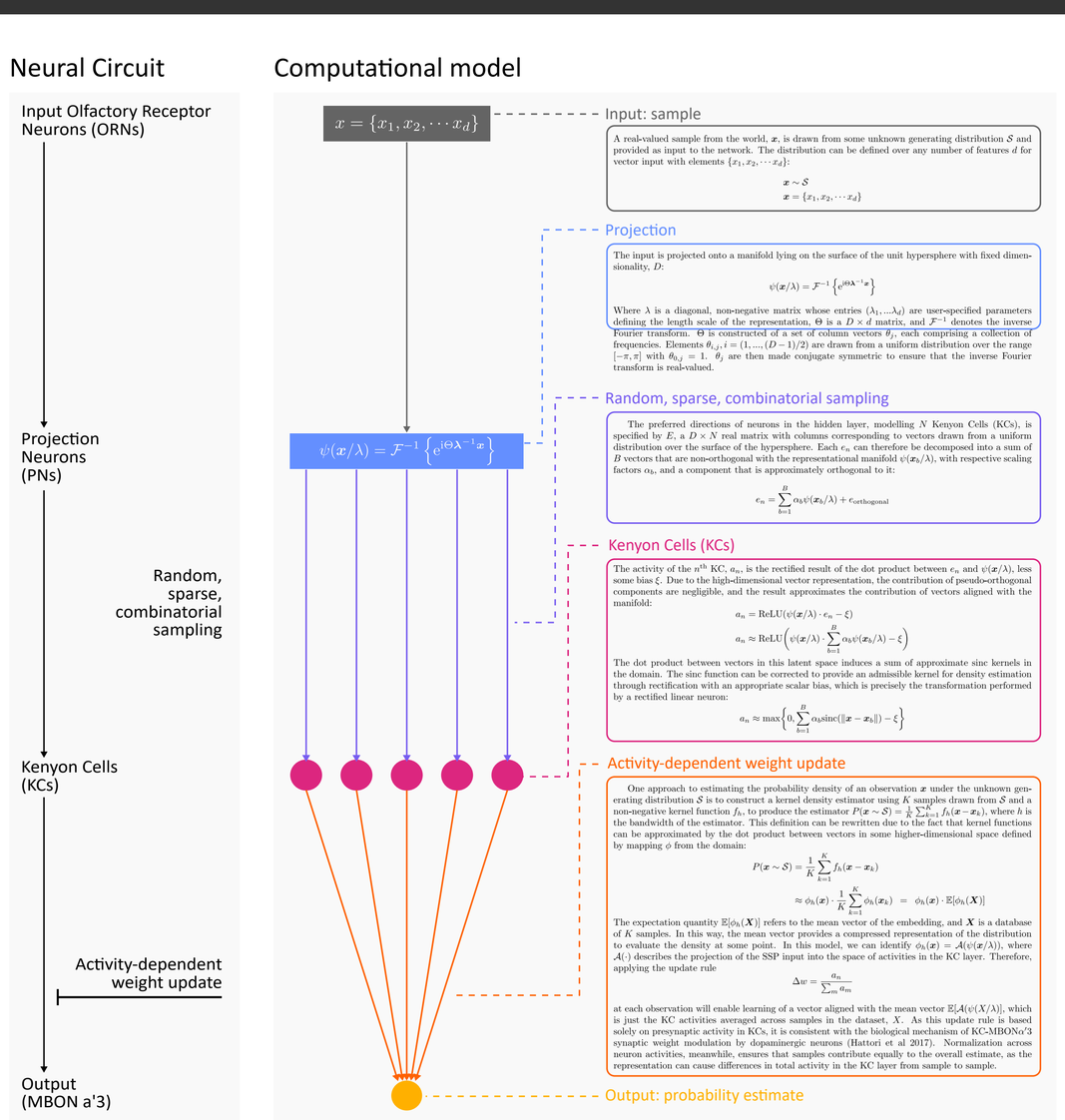
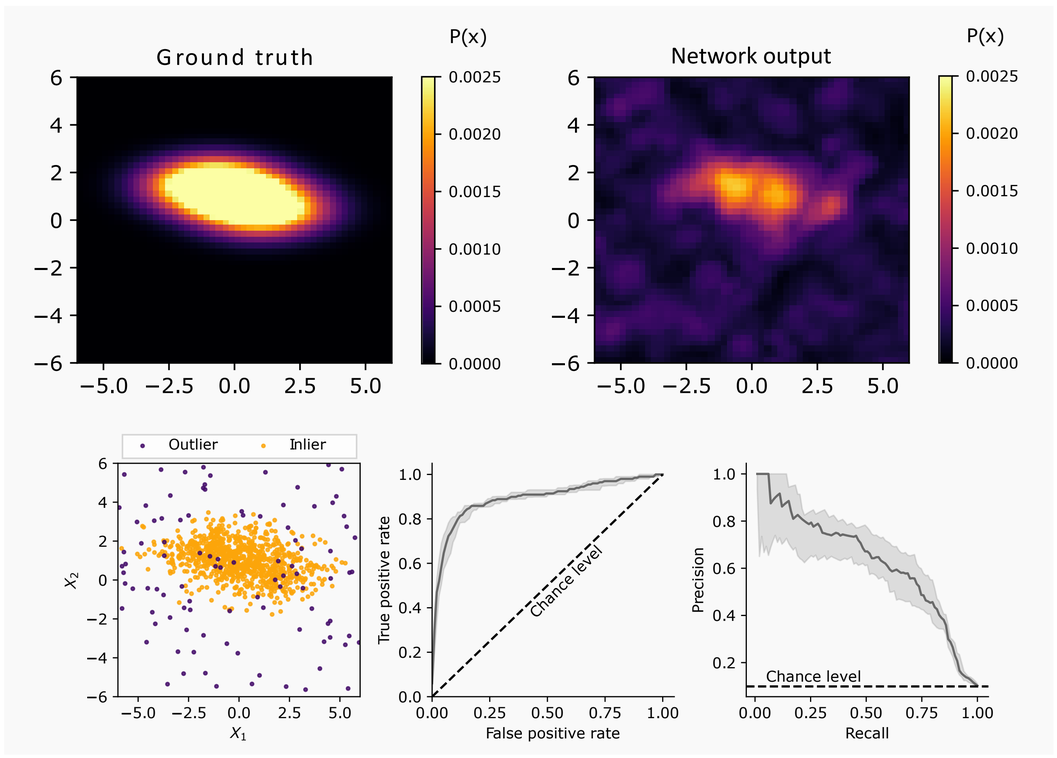
1. Introduction

The capacity to recognize an unfamiliar situation is essential for survival. In the insect mushroom body, a single feedforward circuit controls the alerting response to novel odors, but the high-level algorithm being executed remains unclear. Previous work has shown how the locust mushroom body circuit could act as a probability density estimator, but it is unclear if this model could apply to the neurobiology of the fruit fly, a widely-used animal model in neuroscience.

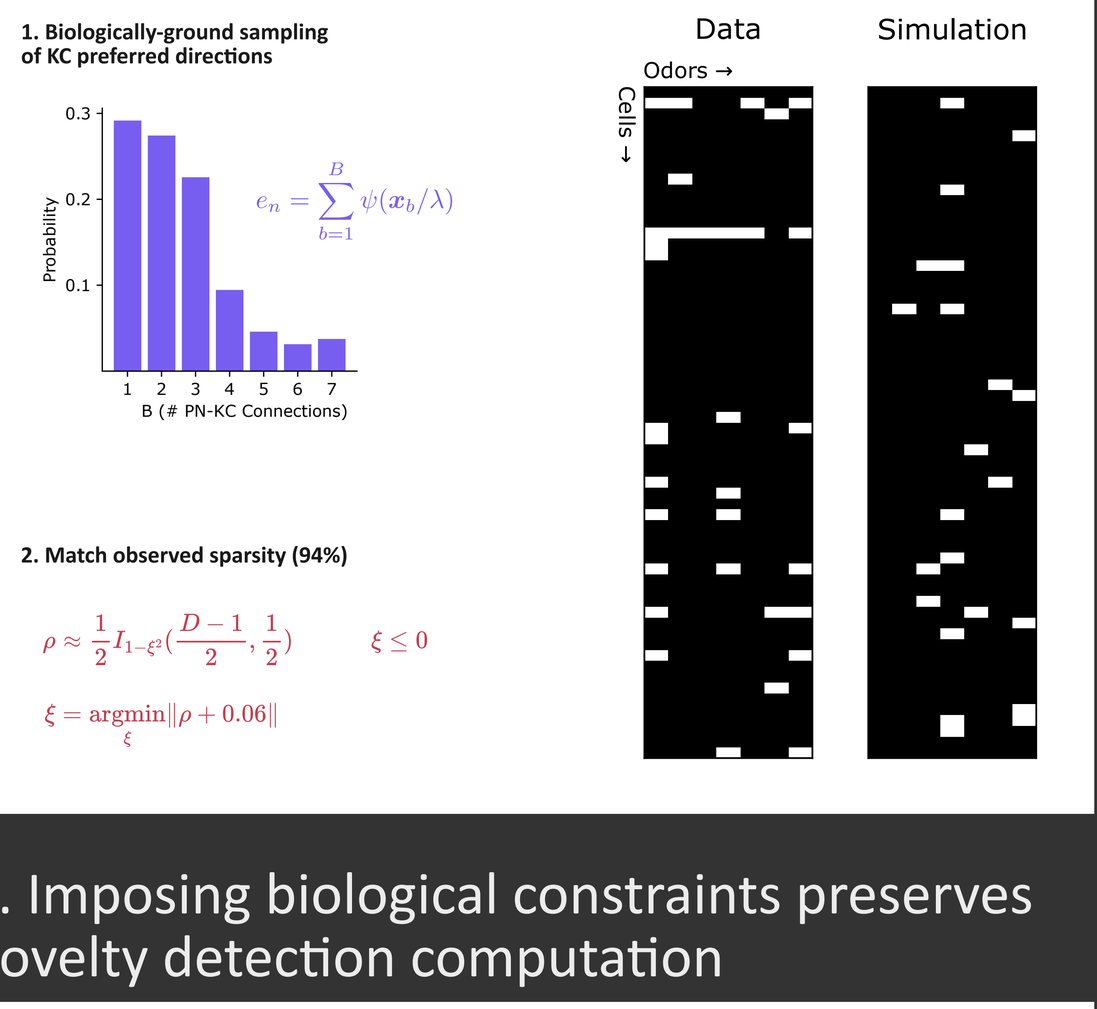
2. Interpreting the KC-MBONα'3 circuit as a kernel density estimator



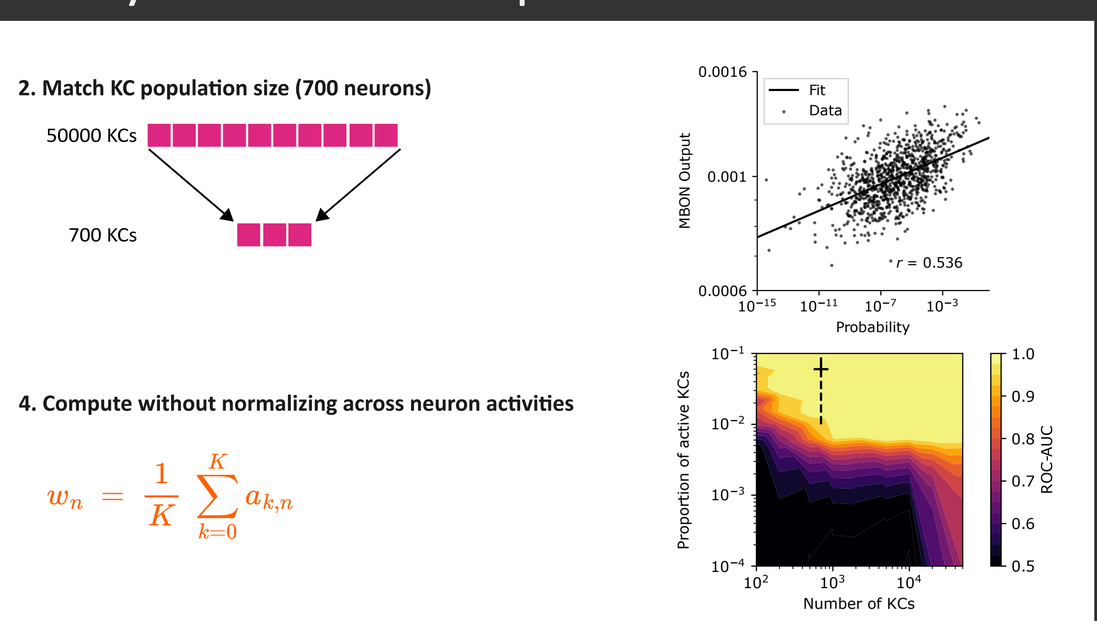
Demonstration



3. Incorporating neurobiological details reproduces characteristics of KC cell responses



4. Imposing biological constraints preserves novelty detection computation



5. Conclusion

Density estimation is a promising proposal for the algorithm underlying insect novelty detection. These findings uphold this interpretation by showing how it applies when constrained by the neurobiology of the fruit fly. We therefore offer a viable alternative to the Bloom filter interpretation.

References

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