Summary of Research Progress Since the Last Report:

Methods paper for using mmpose and benchmarking performance of foundational models:
I have been transitioning my model pipeline from a non-generalizable keypoint detection network, to a cutting-edge library called mmpose, capable of using various models. This project has expanded into a methods paper where I am developing a generalizable pipeline for converting keypoint detection from DeepLabCut or SLEAP to mmpose. I have a full draft and versions of my figures that I will present in this meeting.

Evaluating keypoint choice for data-efficient mouse behavior classification:
After our 8-page manuscript got rejected from the conference Computer Vision and Pattern Recognition (CVPR), I wrote and **submitted a paper** to a CVPR workshop (2025) called CV4Animals. It is a condensed version of some of the content from our original rejected manuscript that focuses on the decision for which keypoints to use for behavior classification. We will get the news on April 28 (the day of the TAC meeting!) if the workshop paper has been accepted to be presented at the CV4Animals workshop. This is also a double-blinded submission.

Maze paper on cognitive decline in B6.SAA and C57BL/6J aging mice
Most of my work on the maze paper over this past time period has been on running more experiments. We collaborated with the Howell and Sasner (MODEL-AD) groups to get mice in our pipeline. I finished data collection and will get to analysis of these B6.SAA mice once I finish up the mmpose methods manuscript and the homeostatic paper.

Homeostatic paper:
I have worked on re-scoping out this paper and have plans to finish the manuscript this summer.

Other things I have been involved in:

- Co-lead of the student-run Genetics Journal Club
    - just finished, no more Genetics JC for me
- JAX graduate student council rep, Tufts student council rep
    - these end in the Fall
- Leading Tufts computational biology club
    - passing this on at the end of this month

Summary of Research Plans for 2025 Fall TAC meeting:

I am finishing up the MMPose manuscript, and will aim to submit it before the summer. My summer will be spent on finishing up the homeostatic manuscript. Following that, I will be working on maze analysis and processing into my manuscript. This will be the large bulk of my

work after submitting my other two papers. After that, I would like to have some discussions on graduation timelines (in our next meeting)!

Highlights of Results:

Methods paper for using mmpose and benchmarking performance of foundational models: This paper is on using the MMPose library as a tool for benchmarking performance of keypoint models. This is a general-purpose tool that can be adopted for mouse tracking tasks. The best model varies in terms of what the user is looking for, and what dataset they are using.

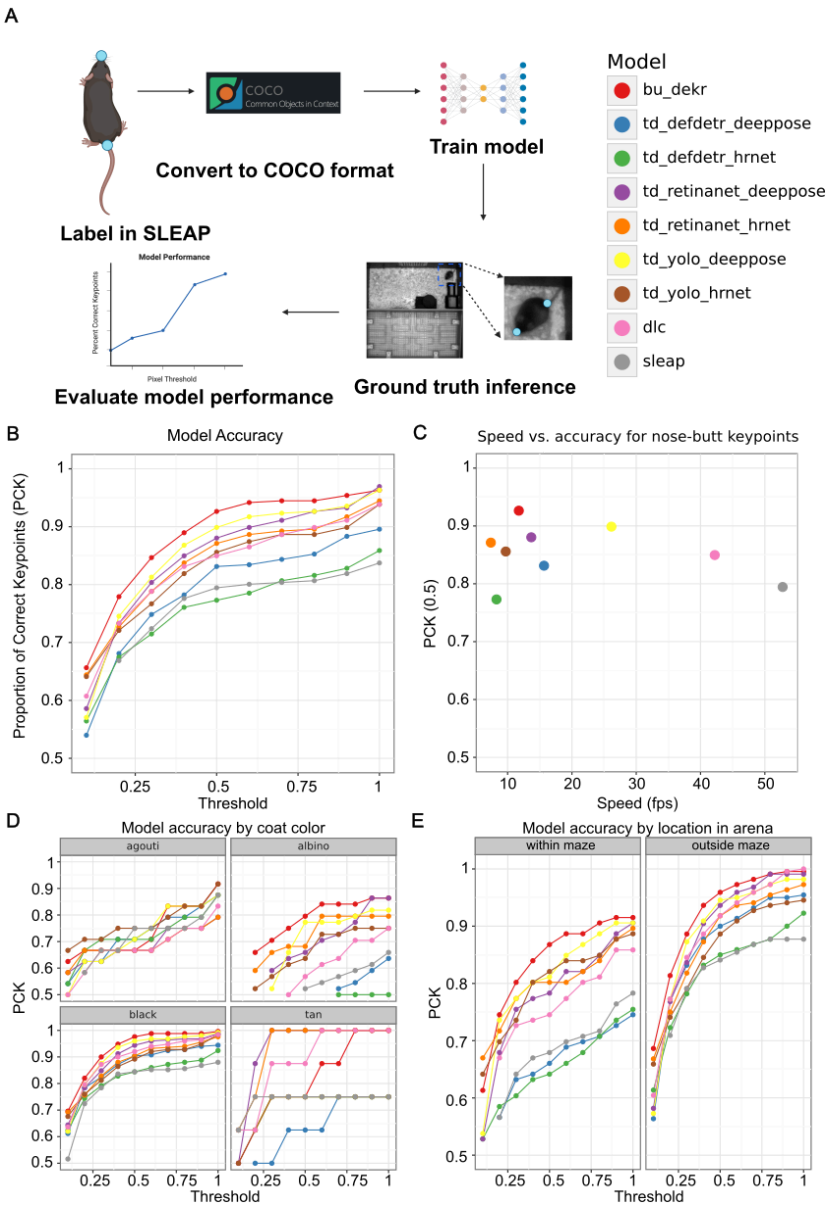
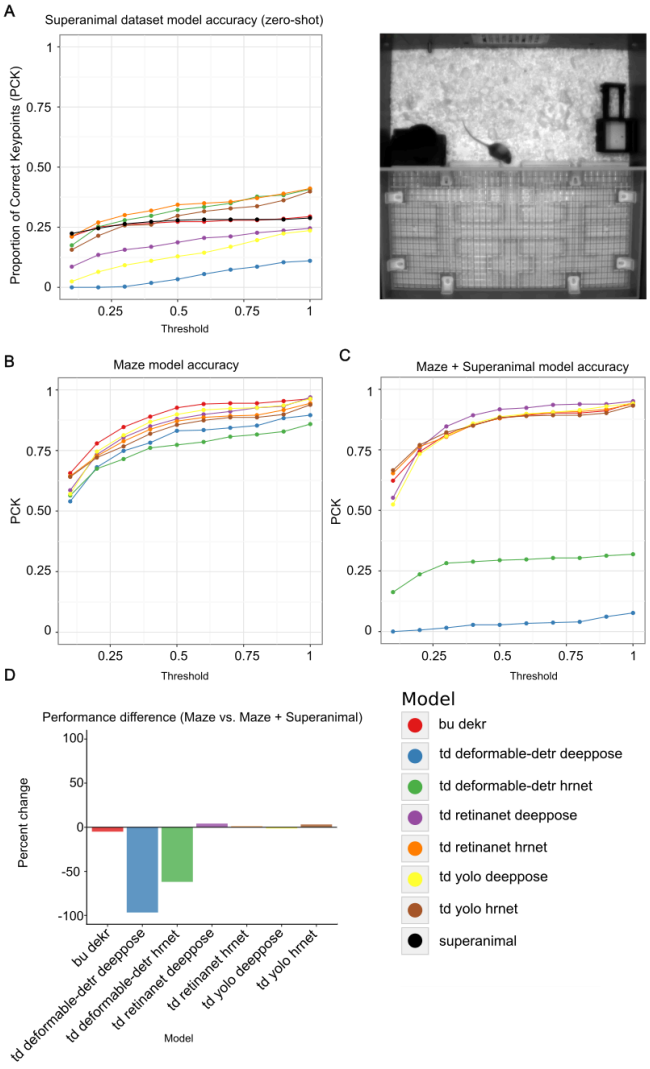


Figure 1 is showing the general pipeline for using MMPose in mouse tracking. This is on a complex (difficult) dataset with obstructions and diverse coat colors. We report the model accuracy as well as speed for performance. We further break down performance of each model by mouse coat color and if the mouse is within or outside of the maze.

Figure 2 is showing a comparison of using a “foundation” model in the mouse tracking field called Superanimal on our complex dataset. We find that generally, using a specific dataset is more beneficial in terms of performance rather than adding more diverse frames from other datasets. Perhaps with more training data in the Superanimal dataset, performance would start to improve and be more generalizable.



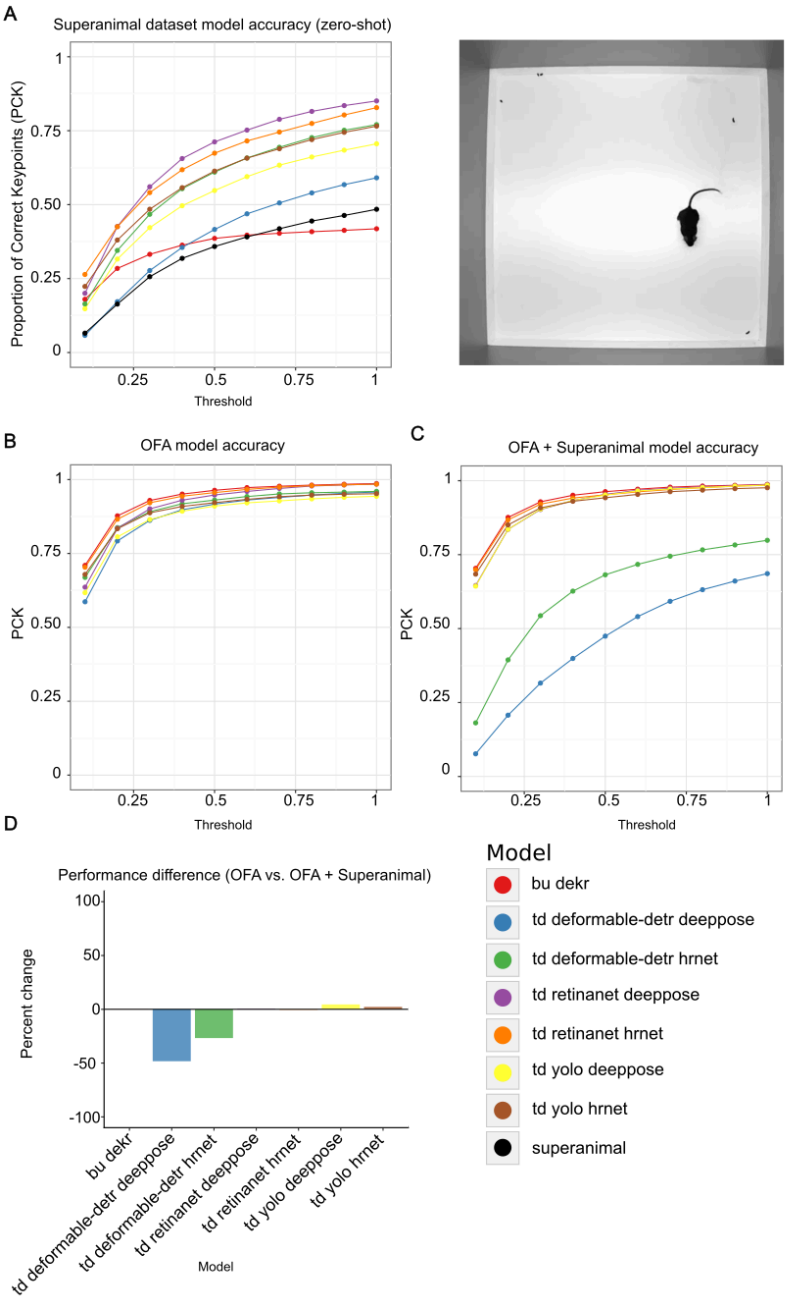


Figure 3 is on a simpler task on a typical open field with a white background. In this scenario, the zero-shot superanimal performance is better than in the complex dataset, however, using the specific training dataset is still more beneficial.