Computer Vision to Support Neuroscience

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Presented for Arbor Biotechnologies on February 15th 2022

Background: Mouse Behavioural Studies

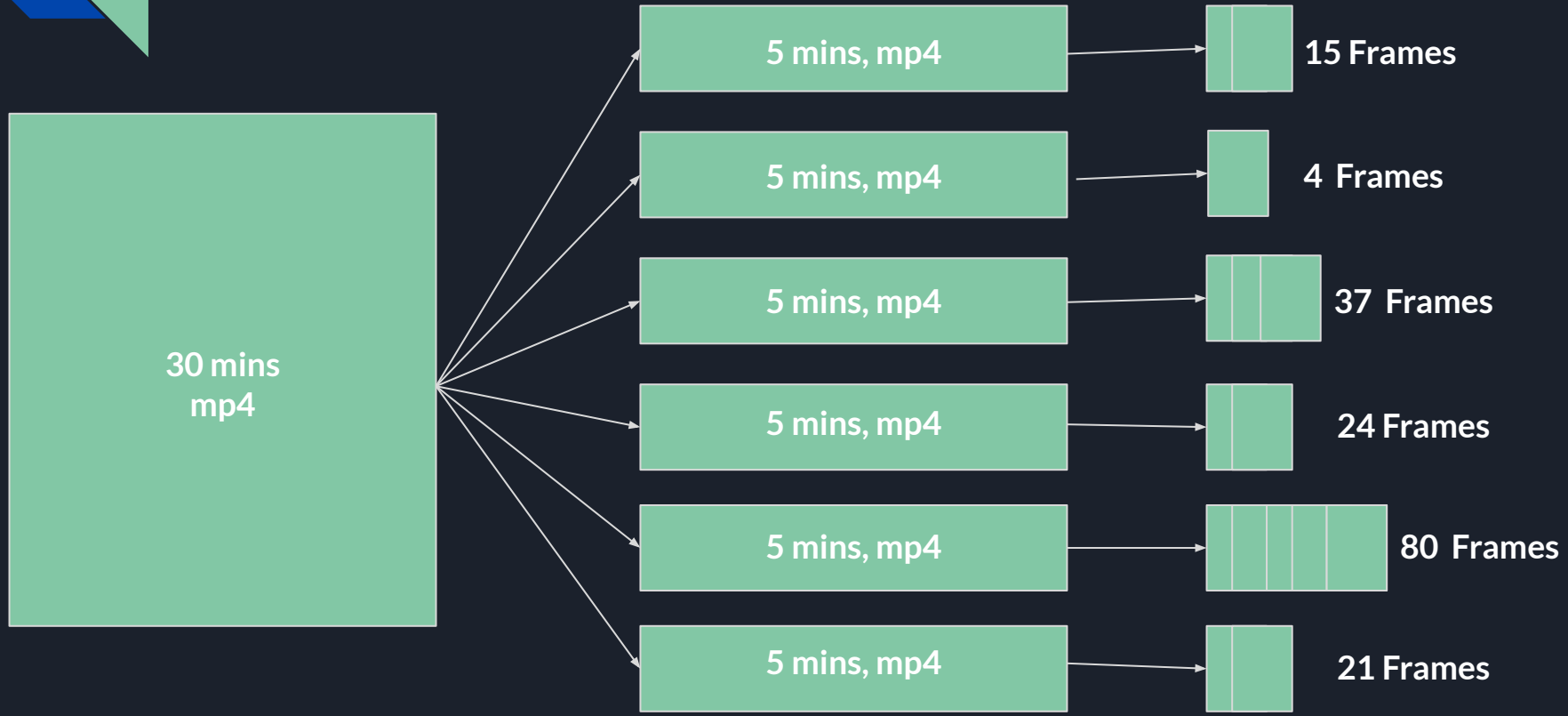
Problem Definition

Inefficiency & Accuracy

Solution: An Overview

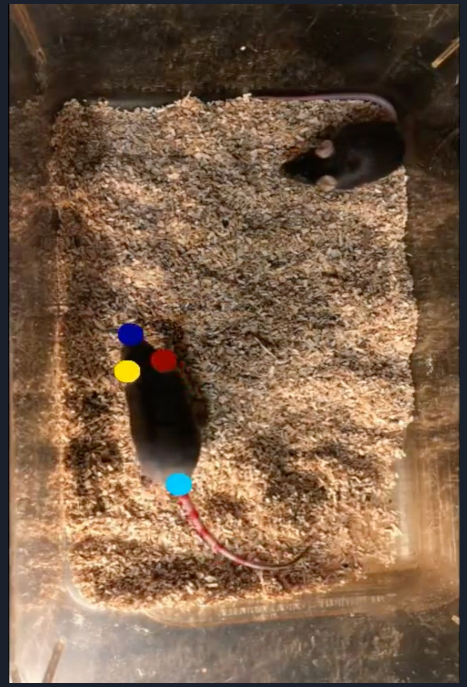
1. Detect mouse in video frame
2. Track mouse throughout video
3. Do this for both mice
4. Analyze Data
5. Derive meaningful interpretation from data

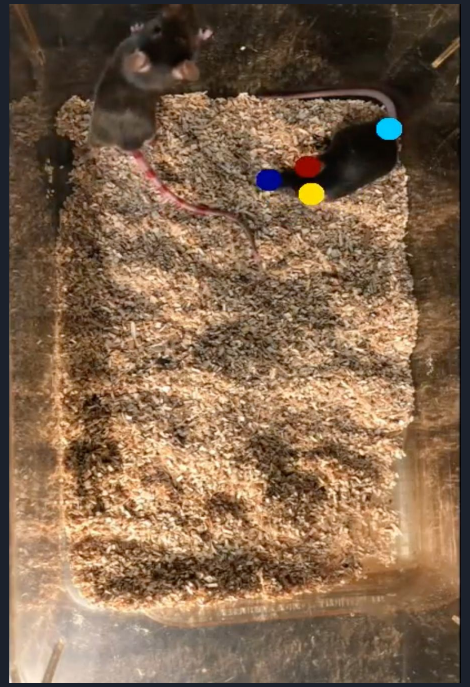
Data Manipulation

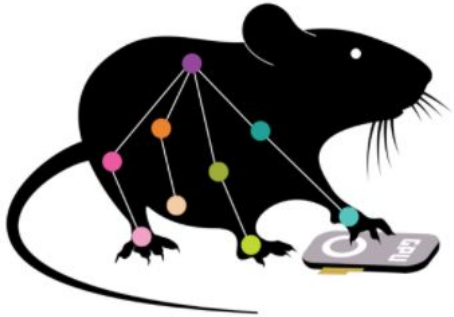


Annotation

ResNet-50







DeepLabCut:

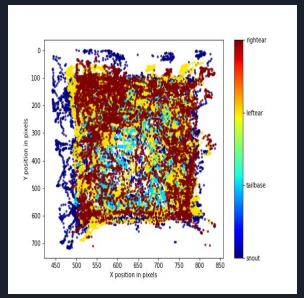
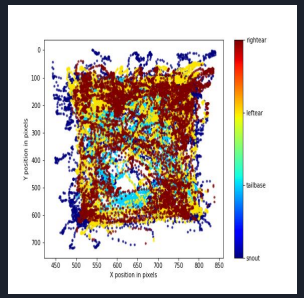
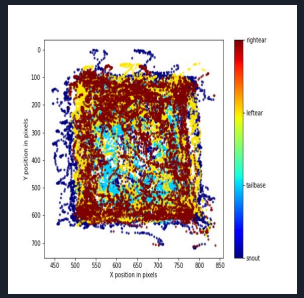
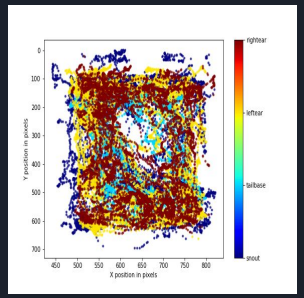
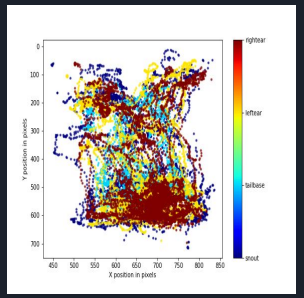
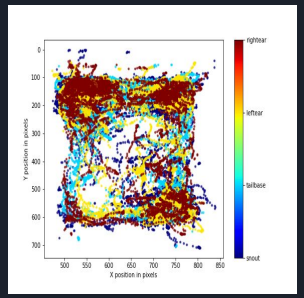
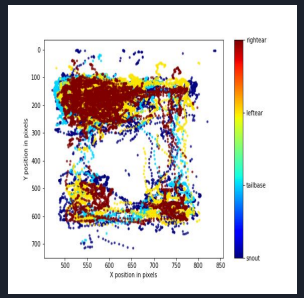
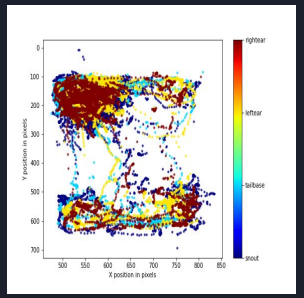
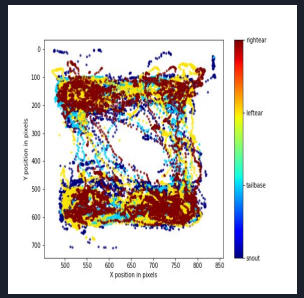
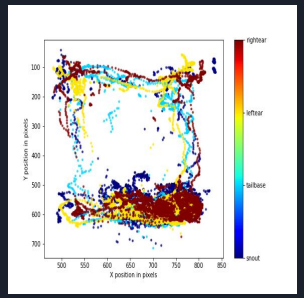
a software package for animal pose estimation

Solution: An Overview

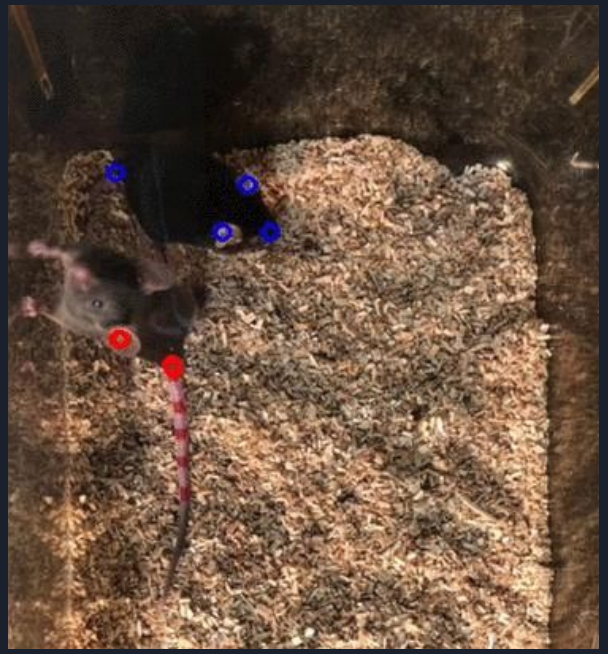
1. ~~Detect mouse in video frame~~
2. ~~Track mouse throughout video~~
3. ~~Do this for both mice~~
4. Analyze Data
5. Derive meaningful interpretation from data

1. Cut video down to manageable chunks
2. Extract frames from video
3. Usage of unsupervised learning to track

Mouse trajectory

	Minute 0-5	Minute 5-10	Minute 10-15	Minute 15-20	Minute 20-25
Stripped Tail Mouse					
Plain Tail Mouse					

Mouse Interaction

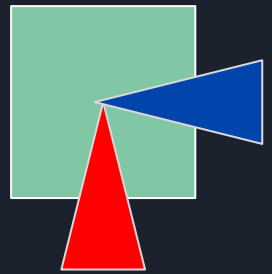


Striped Tail Mouse
initiates approach

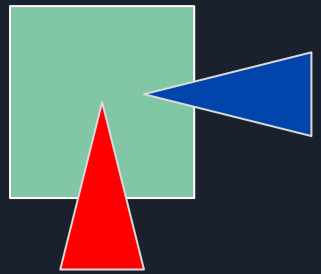
Plain Tail Mouse
initiates approach

Backtracking Algorithm: Blue Initiation

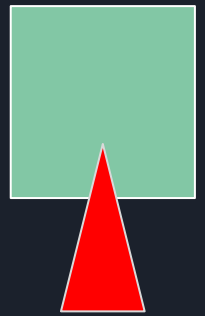
Time of Collision



Blue Enters Collision Region



Red Enters Collision Region



Discussion

- Multi-animal tracking could have been better. There were some cases of quick identity swapping
    - However, after a couple of frames the identities switched back.
    - Models could not account for when animals were overlapped
- Collision region could have been constructed better
- Instead of just using key features we could have created a bounding contour of each mouse for more precise collision detection.