Computer Vision for Resident-Intruder Monitoring using KNIME

KNIME Data talks – June 1, 2022.

Who are we?

Scientific Computing – Drug Discovery – Idorsia Pharmaceuticals

Idorsia Pharmaceuticals Ltd.

- Based in Switzerland
- ~1200 employees
- QUVIVIQ & Clazosentan Approved
- Positive PIII for Aprocitentan

idorsia

Who are we?

Part deux

Me (Aaron):

- Background in flow cytometry data analysis

- Former KNIME AG support engineer

- Cloud computing advocate

My team (Automation):

- Genomics preprocessing pipelines

- *omics data integration

- Ultra large-scale virtual screening

- Self service infrastructure platform
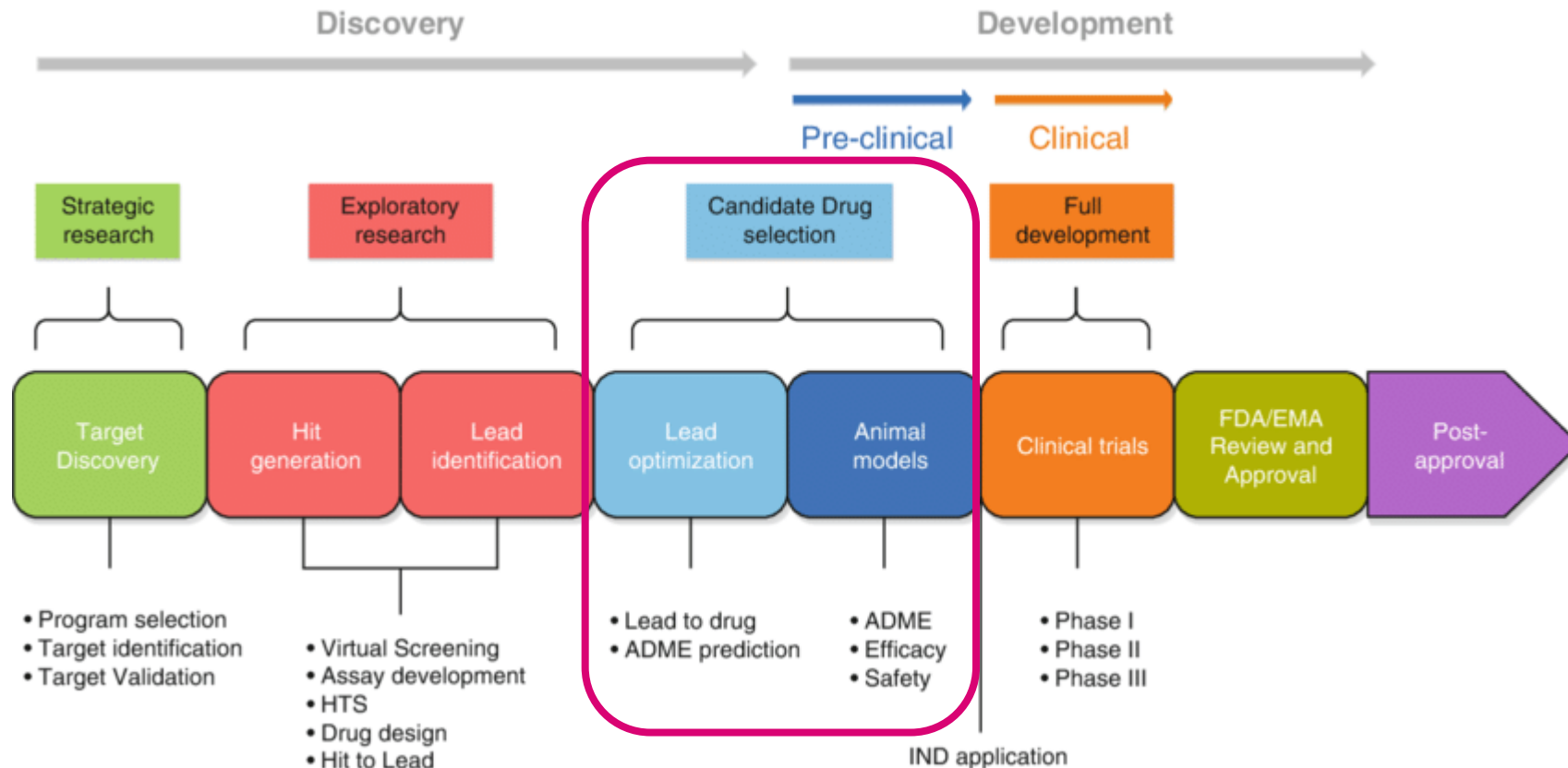
- Many one-off data analysis projects

My Group (Scientific Computing):

- Supports Drug Discovery

- Biology, Chemistry & Pharmacology

- FAIR Data

idorsia

Drug Discovery Process

Today, we are here

Duelen, Robin & Corvelyn, Marlies & Tortorella, Ilaria & Leonardi, Leonardo & Chai, Yoke & Sampaolesi, Maurilio. (2019). Medicinal Biotechnology for Disease Modeling, Clinical Therapy, and Drug Discovery and Development. 10.1007/978-3-030-22141-6_5.

idorsia

Searching for an animal model for dementia

- Old people who suffer from dementia often present with a broad range of behavioral disturbances, namely neuropsychiatric symptoms (NPS).

- NPS represent a large burden to the patients and current treatment options are unsatisfactory.

- We are searching for novel treatment modalities in this area and need a good animal model with comparable symptoms to be used for drug screening.

- The Senescence Accelerated Mouse-Prone 8 (SAMP8) strain of mice shows an accelerated aging phenotype that includes the development of brain atrophy and cognitive decline.

- Agitation is one of the most prevalent and debilitating NPS occurring in people with dementia. Reactive aggressive behavior in male mice can be studied as a behavior with translational relevance for agitation.

idorsia

Scientific Background II

Resident Intruder Paradigm

- Established model for monitoring aggression

- Intruder mouse is introduced into the enclosure of the resident

- Aggressive encounters are tabulated over a period of 10 minutes

- Manual scoring of videos is cumbersome

- Existing CV methods using pose detection have so far been impractical to implement reliably
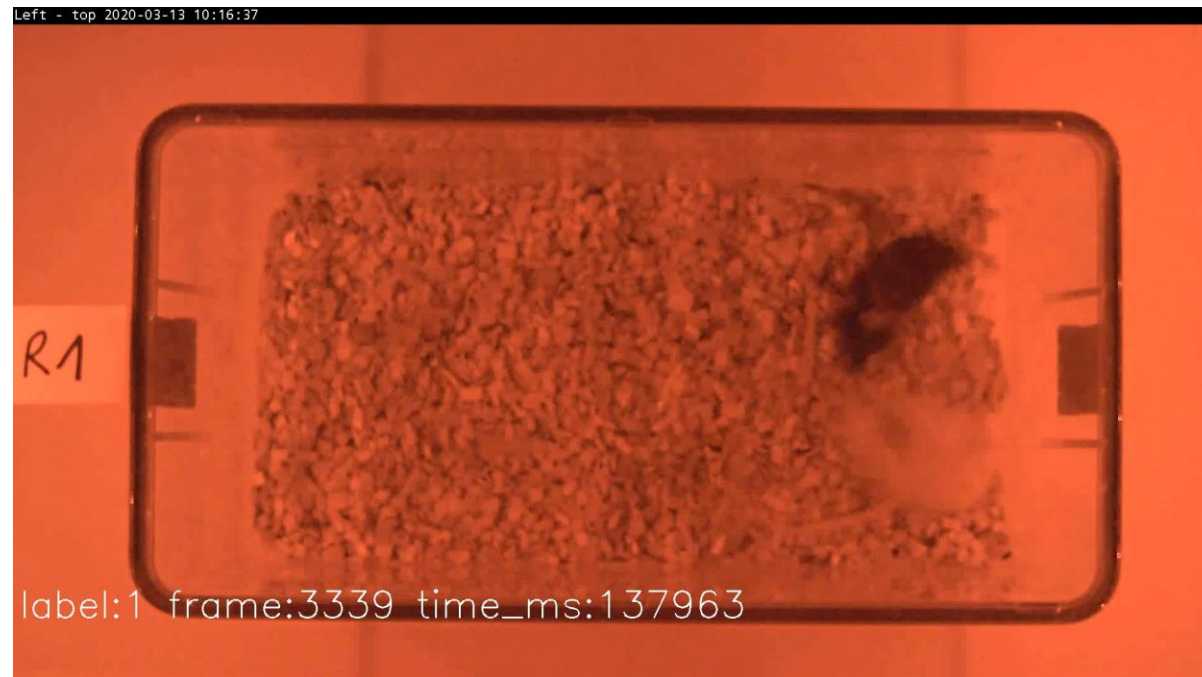

idorsia

Pose Free Aggression Monitoring

Relatively difficult from an ML point of view.

Challenges

- Aggressive events are rare and usually short lived (<1% of the data)

- Training data is relatively hard to come by (lots of manual work per positive example)

- Behavior is in the time domain, so single frame classification is insufficient.

# Pose Free Aggression Monitoring

Our algorithm

- Learn behavior from differences between consecutive frames.

- Standard CNN architecture with minor tweaks in weight initialization

- Significantly outperforms more typical CV approaches with very few parameters (~10k).

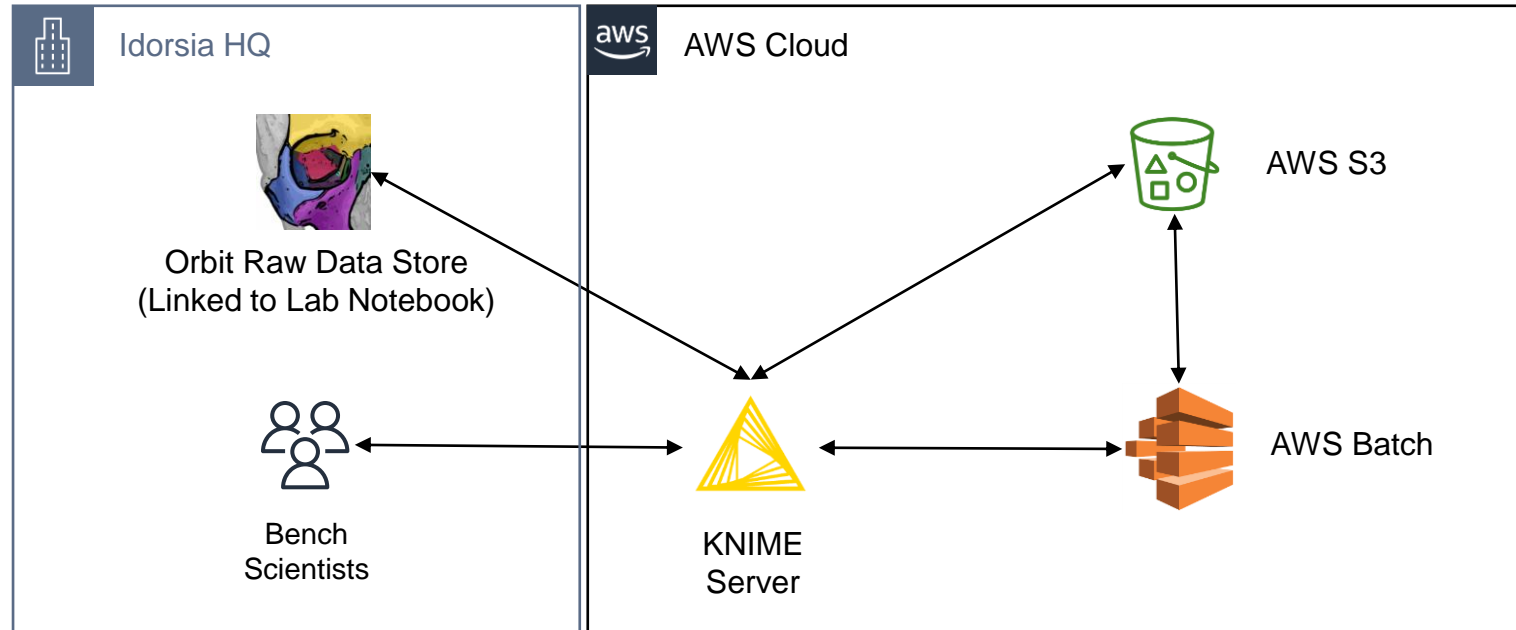
label:1 frame:3338 time_ms:137963
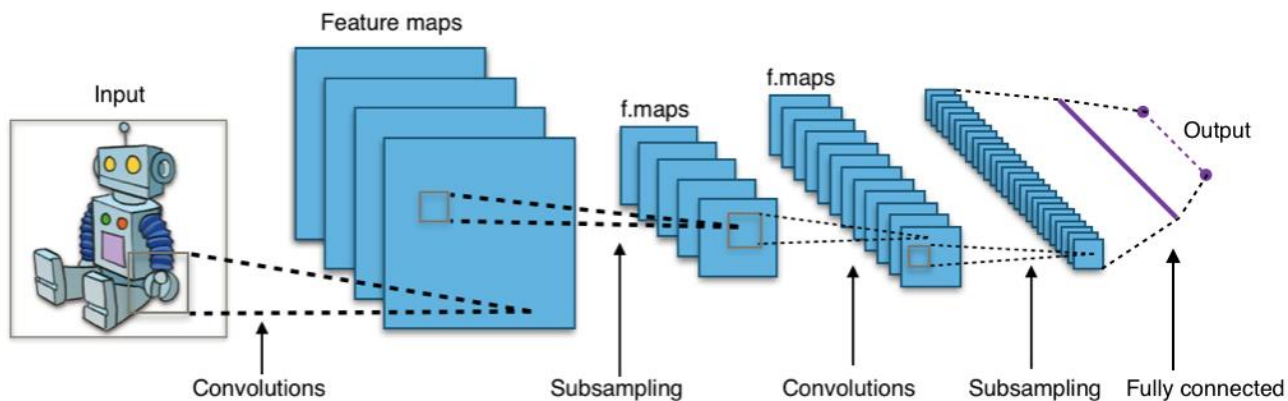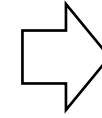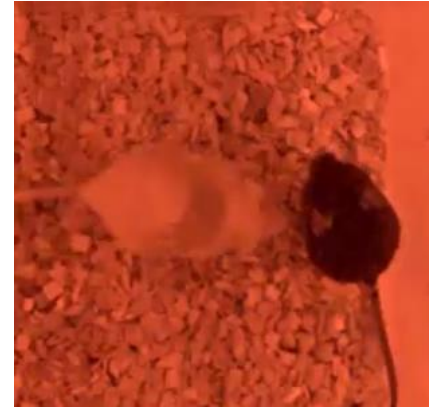
Pose Free Aggression Monitoring

Results

- AUC in the low-mid nineties.

- Results for total aggression per period correlate well with manual analysis.

- Measurable differences between treatment groups.
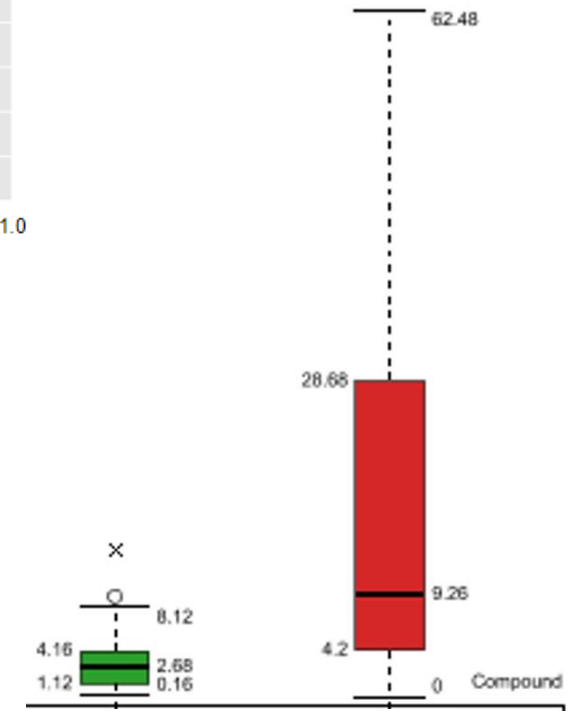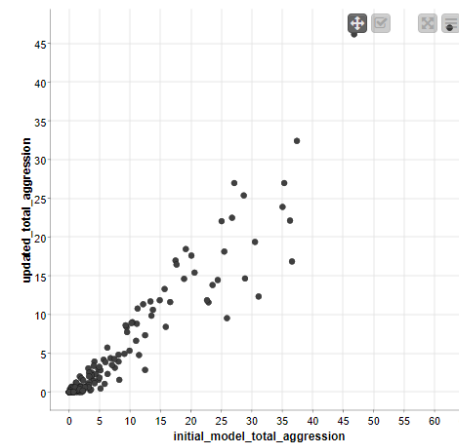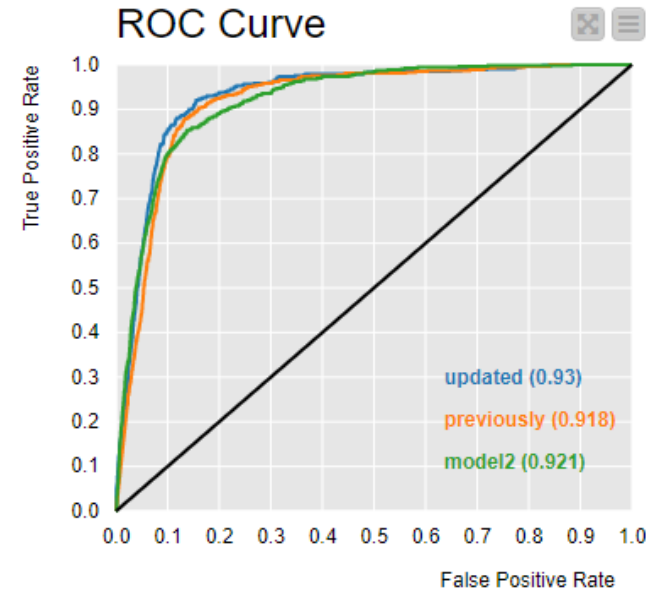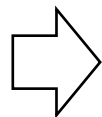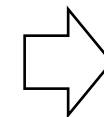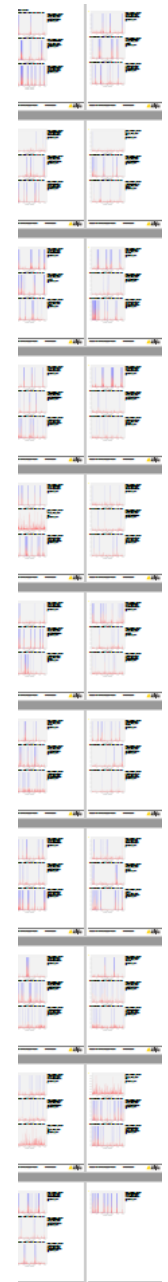
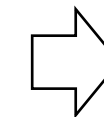# Internal Reference Architecture

Self-service cloud scale workflows.

Assisted R-I analysis

An RI-CV Tool

- Model deployed from a KNIME Workflow

- Actual Inference performed using AWS Batch with SPOT instances.

- Score 10 hours of video in 30 minutes of real time (~CHF5 for 8 hours of compute time)

- Available on-demand 24/7/365 with zero idle costs
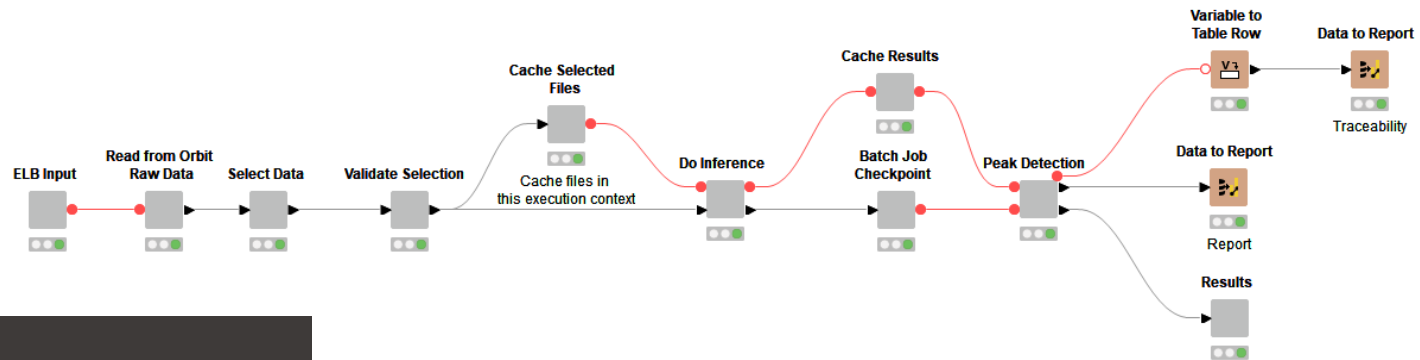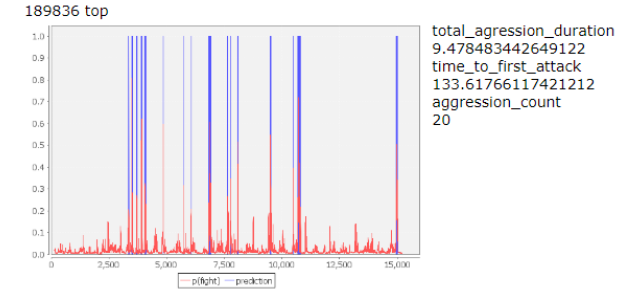
End

Acknowledgements:

Giorgio Bergamini

Helene Massinet

Sean Durkin

Michel Alexander Steiner