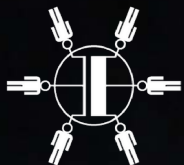


AI Readiness Supplement: CrowdBots

Parent R01: Stalled capillary flow: a novel mechanism for hypoperfusion in Alzheimer disease

PI: Prof. Chris Schaffer, Cornell University
Speaker: Dr. Pietro Michelucci, Human Computation Institute
Collaborators: Laura Onac, Leanna House



HUMAN
COMPUTATION
INSTITUTE

AI-Readiness Virtual Closeout Meeting, NIH

31 October 2022

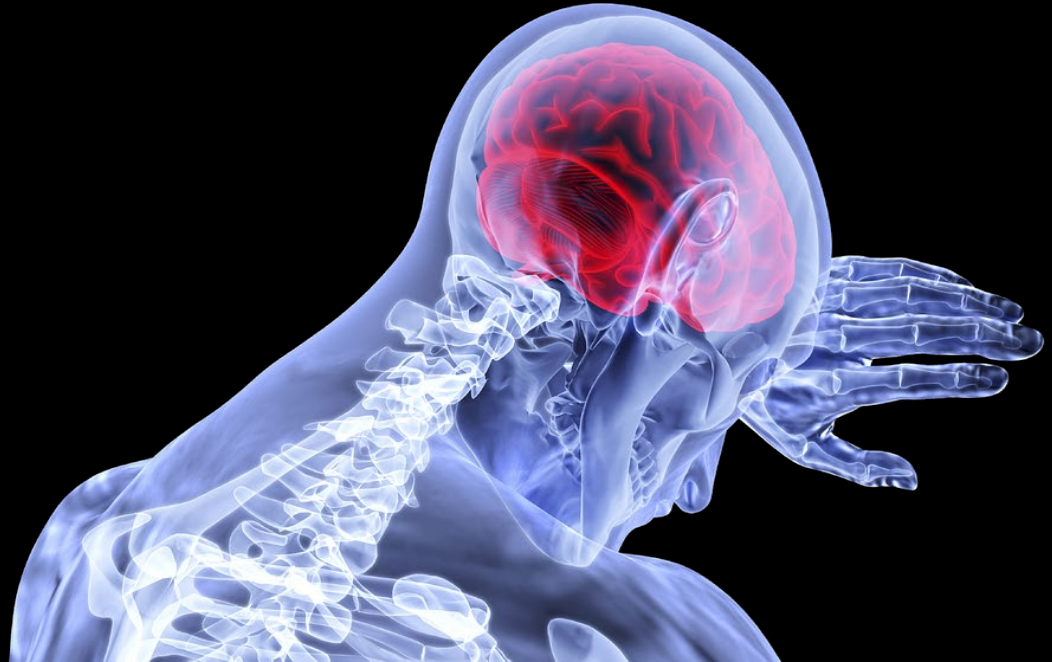
Alzheimer's disease

- neurodegenerative disorder
- one of many types of dementia
- problems with memory, thinking and behavior



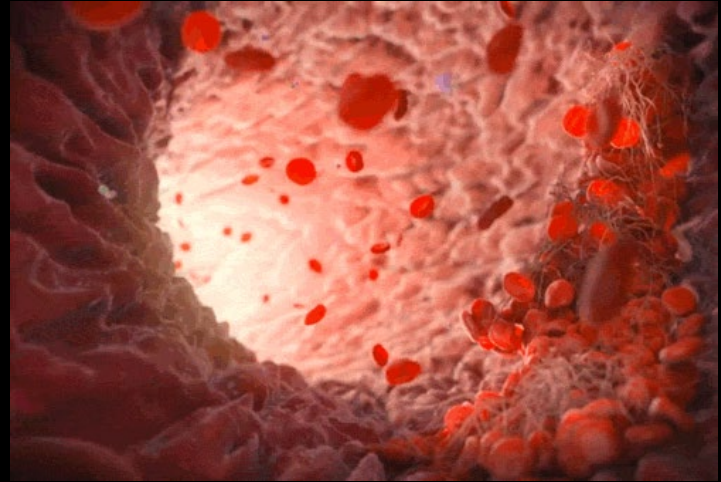
30% less blood flow

in the brain in
Alzheimer's



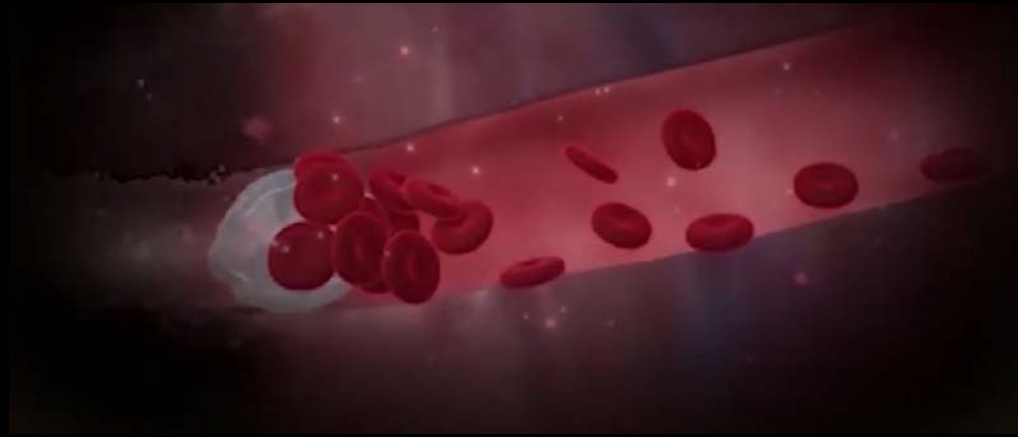
Restoring blood flow restores memory

and reduces other
symptoms in mice



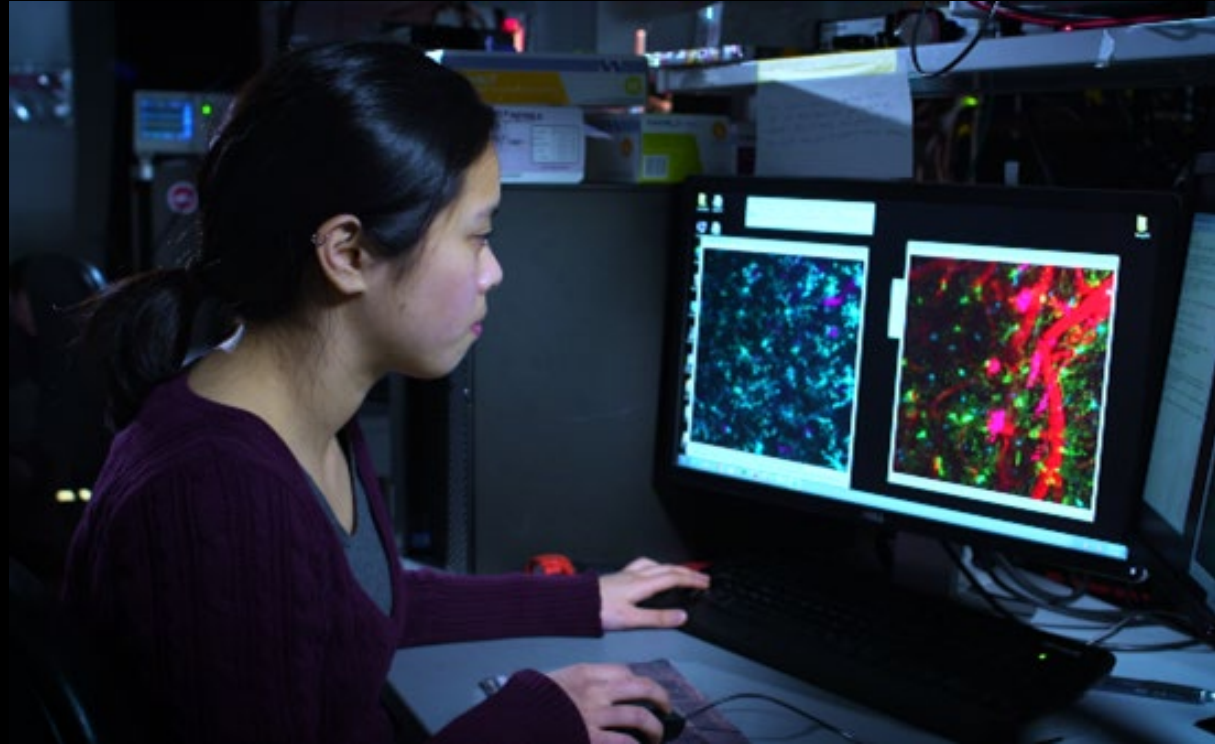
Goal: Alzheimer's treatment

understand the
mechanisms behind
stalls and find a way to
prevent or remove them



6 to 12
months

to answer one
research question
in the lab



Enter Stall Catchers...



>47 000
catchers



50-100
play every day



5x faster
research

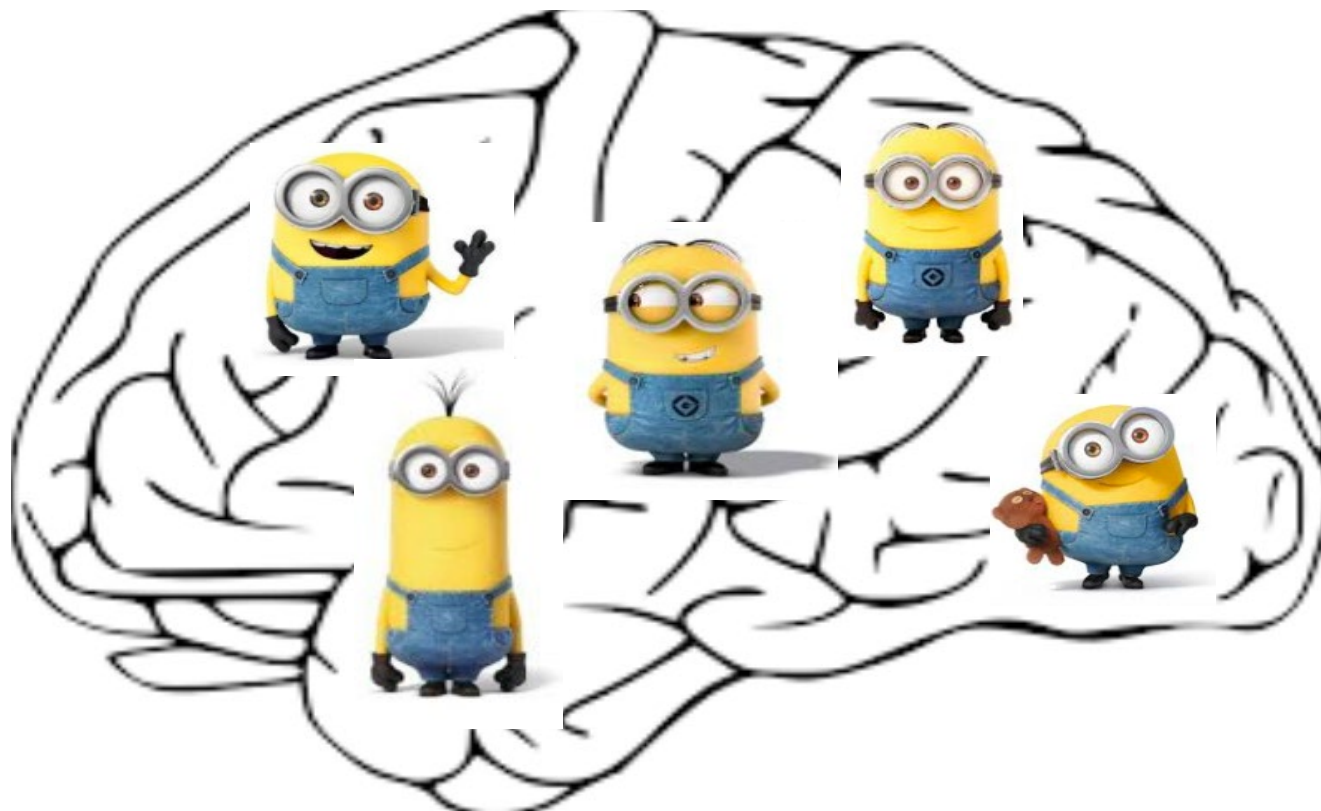


1-2 months
per research
question

This is what it looks like ...



Wisdom of crowds

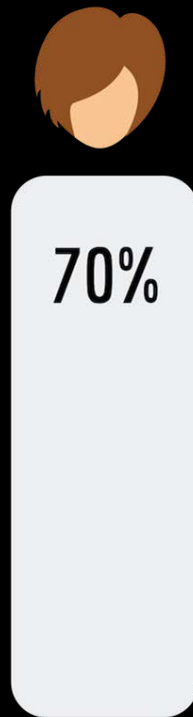


each individual annotation
matters

crowd answers

→ 99%

accuracy!



70%



90%



99%

Machine Learning Challenge

DRIVEN DATA

COMPETITIONS

ABOUT

CAREERS

DRIVENDATA LABS

BLOG

LOG IN

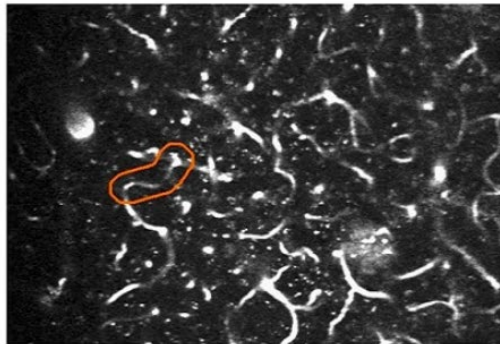
SIGN UP

Clog Loss: Advance Alzheimer's Research with Stall Catchers

HOSTED BY MATHWORKS

2
MONTHS LEFT

[HOME](#) [PROBLEM DESCRIPTION](#) [ABOUT](#) [MATHWORKS](#)



Day 27 of 30-day
Challenge

87.3%

Autoscroll
 Show answer

Score 702
Level 1
Next 735
Rank 477
Movies 2
Stalls 2

Top Ten Catchers

1. Donna	1905079
2. capranom	18728426
3. Jfranco	5593229
4. Tom Adams	1048184
5. msbmibus	1062117
6. Sean4040	1381706
7. Chris Dawson	1289816
8. user172	1000224
9. Muhammad	922039

\$10,000

LEADERBOARD

You're not part of this
competition. Yet...

Join the competition!

SHARE THIS:

Facebook

Twitter

LinkedIn

Email

Flowing

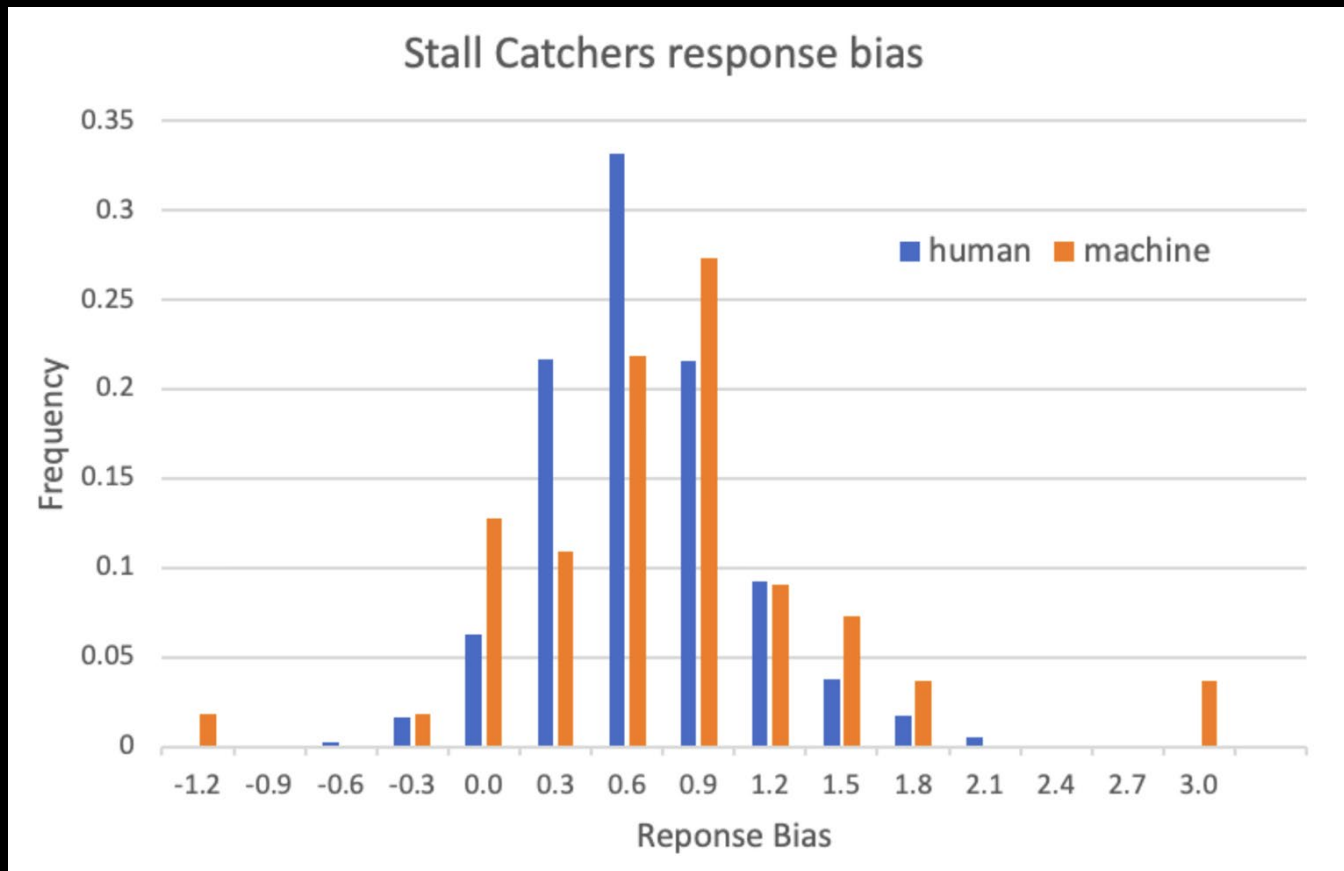
Flag movie

Stalled

29



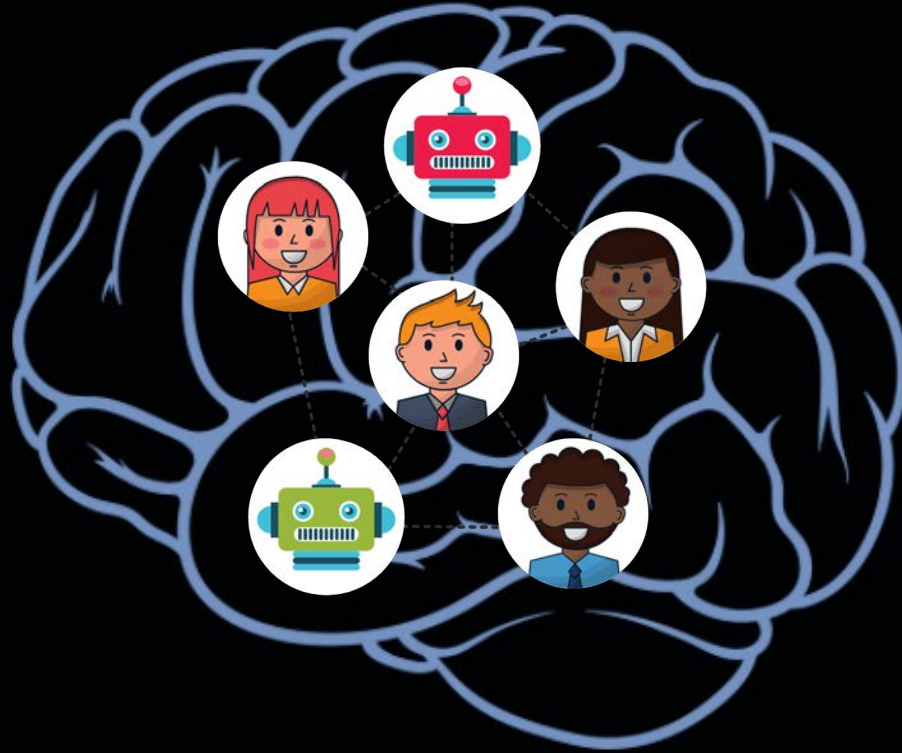
Diversity



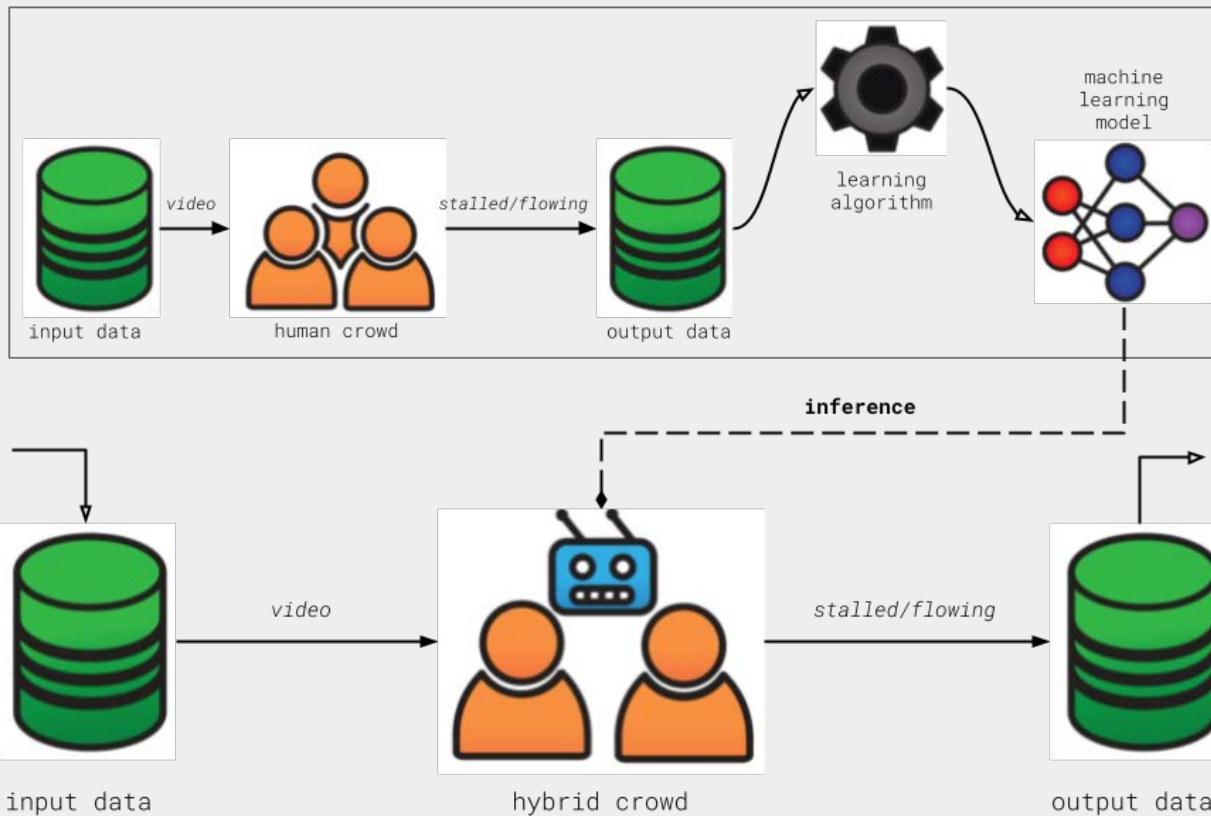
Fundamental Differences

Username	Preprocessing	Training	Architecture	Response
ZFTurbo	Region of interest extraction	5KFold cross-validation	DenseNet121 3D	Combined 5-model output
kbrodth	Normalized X-Y and padded Z	Resampled stalls to equalize base rates	ResNets 3D CNN	Multi-epoch outputs were averaged
LauraOnac	Normalized ROIs + rotations and flips	Same-size dataset subsamples to maximize diversity	Three distinct spatio-temporal architectures	Ensemble model based on 2 out of 3 vote

Wisdom of Agents



CrowdBots in Stall Catchers










Open Source API

hcinst / crowd-bots Public Edit Pins Unwatch 3

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[main](#) [3 branches](#) [0 tags](#) [Go to file](#) [Add file](#) [Code](#)

 **pmichelu** Create resource_links.txt 7a4c151 16 days ago 5 commits

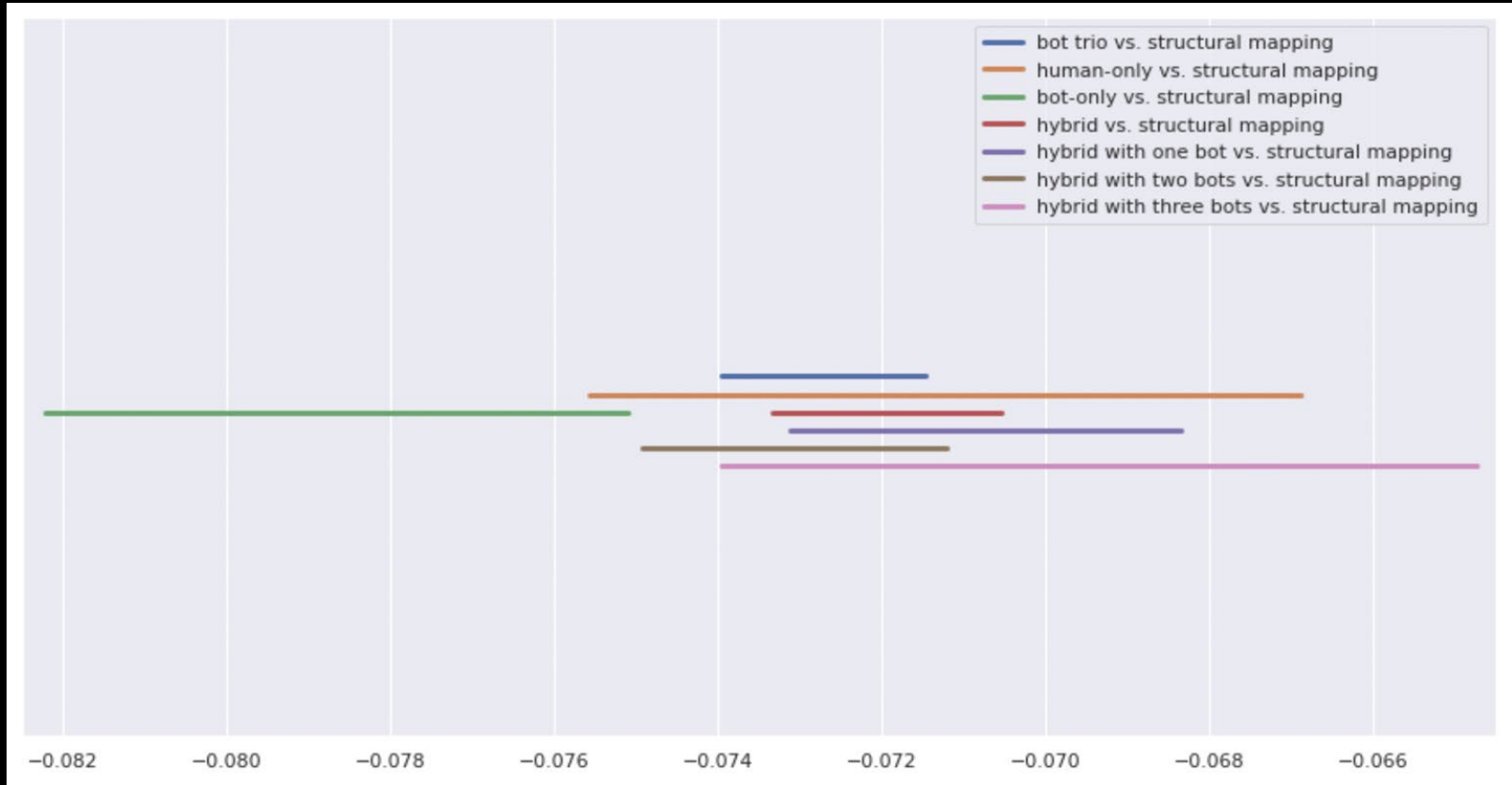
 bot	handle corrupt video files	13 months ago
 bot_gaia	initial commit	13 months ago
 python_wrapper	initial commit	13 months ago
 .gitignore	initial commit	13 months ago
 README.md	initial commit	13 months ago
 resource_links.txt	Create resource_links.txt	16 days ago

One Bot Pilot: Equivalence Test

Equivalence Test showing 95% confidence intervals

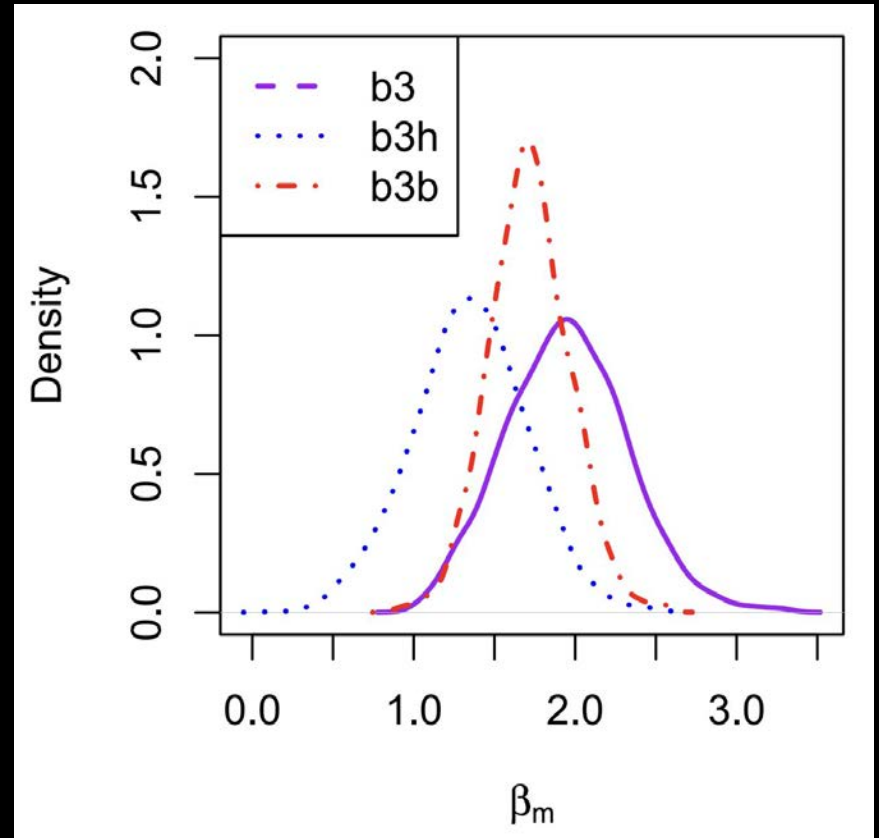


Three Bots - confidence interval test

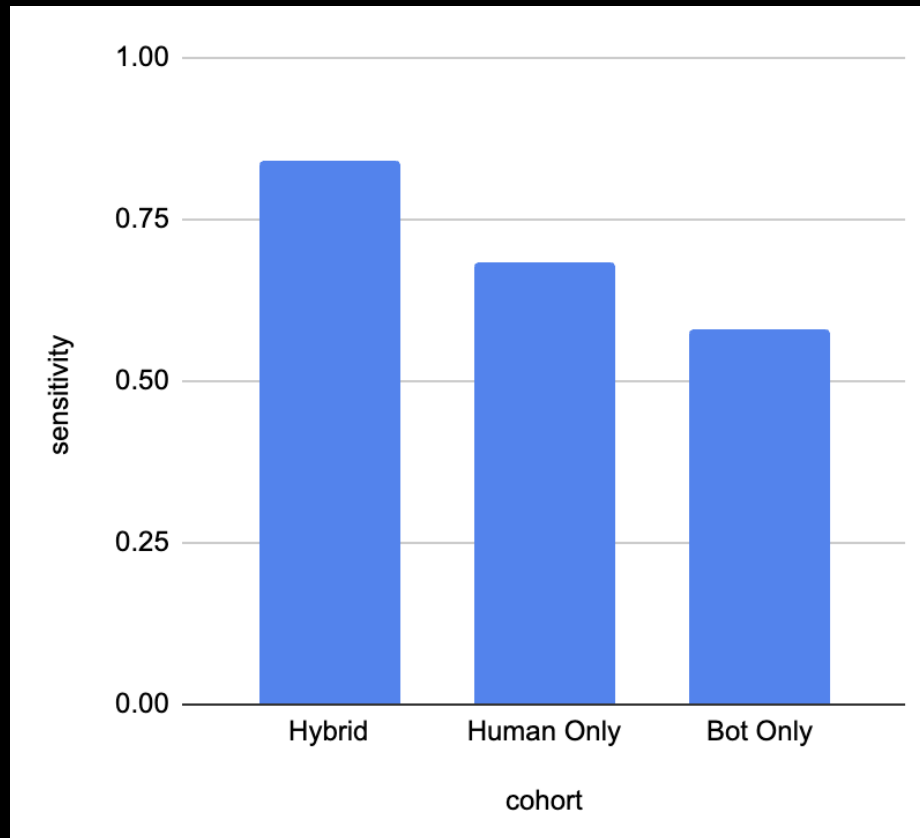


Bayesian Logistic Regression

Hybrid cohorts (b3) are the best predictor of expert data.

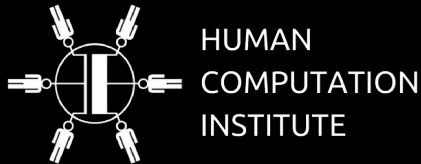


Sensitivity Analysis



Future Work

- Integrate with evolving data science ecosystem
- Dynamic pipeline for continuous model (bot) learning
- Scale to other biomedical research initiatives



Related Publications

Michelucci P, Onac L. CrowdBots: integrating imperfect machine learning models into citizen science. In: *Proceedings from the 4th Annual Conference of the European Citizen Science Association*; Oct 5-8, 2022; Berlin, Germany. Abstract: 127. Online: https://2022.ecsa-conference.eu/files/ecsa/Bilder/ECSA2022_Conference_Proceedings.pdf

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