

EXPLORING THE POTENTIAL OF AI IN THE BIOLOGICAL SCIENCES

PANEL DISCUSSION

HOW CAN AI DRIVE PROGRESS IN BIOLOGICAL SCIENCES?

NEIL LAWRENCE

SARAH MORGAN

HENRIK JÖNSSON

ZOE KOURTZI

LIES DAMN LIES AND BIG DATA!

UNDERSTANDING the BRAIN

Predictions

PREDICTIVE MODELS

OPPORTUNITIES

There's an interactivity we could never have imagined

AND a DARK SIDE

reverse engineer to INTERROGATE THE BLACK BOX!

Scary

I have a SUGGESTION...

IDEAS FOR EXPERIMENTS

AI

HAVE YOU DONE PCA YET?

BIOSCI SERVICE DESK

YOU WANT HUMAN HANDS AT THE CONTROLS

IT'S KEY TO HAVE TRANSLATION FROM ML TO HUMAN

BIG data can help reduce biases... to an extent

There's a LOT of HYPE BUT NOT MUCH ACTUAL TESTING

WE EVOLVED!

6 RESEARCH THEMES

ENGAGE

MIKE BOEMO

BIOSCIENCES IMPACT TEAM + GENOMICS THEME LEADS

JUST THINKING OF ML CHANGES HOW YOU PLAN EXPERIMENTS

OPENING REMARKS

INTERDISCIPLINARIES ASSEMBLE!

Ready to Respond to the calls!

ACCELERATE GIVES YOU ACCESS TO TOOLS

JESS MONTGOMERY

MAY 23

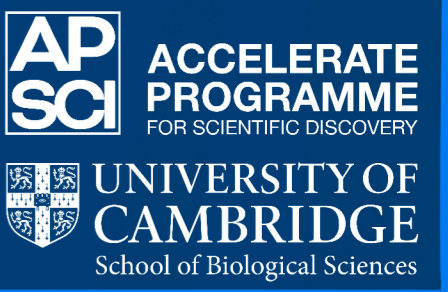
TODAY'S AN EXPERIMENT

VISION ASPIRATIONS PRACTICAL

START CONVERSATION + COLLABORATION TODAY!

MACHINE LEARNING, AI AND BIOLOGY

DOWNING COLLEGE 23 MAY 2023



EXPLORING THE POTENTIAL OF AI IN THE BIOLOGICAL SCIENCES

WHAT RESEARCH QUESTIONS COULD AI HELP TACKLE?

(INFECTIOUS DISEASES) BRIDGING DATA + CLASSIFYING VARIANTS OF CONCERN

interpreting serological data... multi-dimensional antibody relationship

AS A MODEL TO STUDY LEARNING IN OTHER SPECIES

APPLICATIONS IN GENETICS: open chromatin, gene expression

BRIDGING MODELS: MECHANISTIC, DATA DRIVEN

CONSOLIDATING DATA: MICROSCOPIC, MACROSCOPIC

AUTOMATING TEDIOUS PARTS OF RESEARCH

IMAGE ANALYSIS: DIAGNOSTICS

CELL FATE TRANSFORMATION

WE CAN OVERCOME THESE CHALLENGES!

Interacting with THOSE WHO CAN CHANGE POLICY

STEPS TO ACHIEVE THE POTENTIAL OF AI

Open data

TRAINING: Theme/Subject, PIs managing, ML Specialists

Focus GROUPS

Pump-Priming

Funding

HACKATHONS

Genuine interdisciplinary work!

FINDING THE RIGHT CONNECTIONS

Collaboration

Co-supervising students across schools

Support that's centralised

finding the RIGHT QUESTIONS

COMMUNICATION BARRIERS TO INTERACTION

LANGUAGE BARRIER

Keeping up with the field is a Challenge!

UNDERSTANDING A TOOL'S LIMITATIONS

BREAKING DOWN DEPT BARRIERS

CHALLENGES WITH IMPLEMENTATION

data collection STANDARDS & communication

FINDING FUNDING

MACHINE LEARNING, AI AND BIOLOGY

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23 MAY 2023

BIOLOGICAL QUESTIONS THAT COULD HAVE AI SOLUTIONS

LIZ LEE

CAN WE USE AI TO PREDICT BRAIN + MENTAL HEALTH DISORDERS EARLY?

FROM MCI TO ALZHEIMER'S

89% WILL CONVERT 10-15% YEARLY

BaseLine Visit → Tailored Care Pathway

1 Biologically/Clinically Relevant Features

2 Diagnosis Metric Learning Classification

3 Prognosis Trajectory Modelling

STRUCTURAL IMAGE
COGNITIVE ASSESSMENT
ML
COGNITIVE ASSESSMENT
ACER SCORE
MMSE SCORE
MACHINE LEARNING MODEL

ANA CATARINA DA SILVA

CAN WE USE AI/ML TO BUILD DISEASE PREDICTION MODELS USING GUT METAGENOMICS DATA?

99% Genetically Identical BUT GUT MICROBIOME CAN DIFFER BY UP TO 80%

OUR GOOOOAAAAL!

DEVELOP 10's OF 1000's OF SAMPLES

CHALLENGES: SIZE Complexity VARIATION

Can ML Predict HEALTH OUTCOMES

IS THERE A LINK?

Microbiome Composition

Dataset of 53 COUNTRIES

THERE'S PLENTY OF MICROBIAL data IN FECAL MATTER!

BUT YOU MUST FREEZE IT FAST!

EQUAL PARTS MICROBE AND HUMAN

WE ARE

RACHEL TRIMBLE

CAN WE USE MACHINE LEARNING TO IMPROVE CONTROL OF INVASIVE PLANT DISEASES?

WHERE PLANT EPIDEMIOLOGY MEETS RL

OPPORTUNITY FOR AGENT ALGORITHM!

EPIDEMIC MODELLING PREDICTS PROBLEM, NOT THE SOLUTION

THE RESULT: AGENT CONTROLS + EXPELS THE DISEASE!

AGENT GETS REWARD WHEN SUCCEEDS IN GAME

SIMULATION ACTS LIKE A GAMEBOARD

B+ Plant Survival Agricultural yield

TAMSPIN SPELMAN

CAN AI DETECT CYTO-SKELETON DEPOLYMERISATION WITHIN SINGLE PLANT CELLS?

ANALYSING FIBRE NETWORK IN A SINGLE CELL

STARRING THE ARABIDOPSIS ROOT HAIR CELL

ACTIN
MICRO TUBULES

WE'VE GOT TENS OF IMAGES

HOW BIG IS YOUR DATA?

CAN I HELP?

data quality Before After

Quantity of data

Can we detect & track changes in the cytoskeleton when we polymerise and depolymerise?

The issue is the success rate isn't where we'd want it to be

DINITHI SUMANAWEEERA

CAN WE USE AI/ML TO ENGINEER CELL FATE IN THE DISH?

...TO MAP ALL HUMAN CELLS

diagnose monitor & treat health & disease

MISSION...

ENGINEERING CELL FATE... IN A DISH

PRIMARY OR STEM CELLS

CHALLENGING QUESTIONS

is in vitro = in vivo?

QUANTIFY DEGREE OF AGREEMENT

PINPOINT DIFFERENCES

HOW RECTIFY DIFFERENCES

target

informs Signalling Pathway

GENES 2 GENES ALIGNMENT FRAMEWORK

EMILIA SANTOS

CAN WE USE AI FOR HIGH THROUGHPUT MORPHOLOGICAL AND BEHAVIOURAL PHENOTYPING?

A GREAT MODEL more diverse than humans within and between species

BEHAVIOURAL PHENOTYPING

SPECIES RECOGNITION

SEGMENTING CELL TYPES

CAN AI HELP EXTRACT PATTERNS THAT HUMANS CAN'T SEE?

Body Pigmentation

CRANIOFACIAL VARIATION

MORPHOLOGICAL PHENOTYPING

CICHLID FISH

ENGAGING WITH CAMBRIDGE RESOURCES TO SUPPORT RESEARCHERS

Can we use AI to... **YES!** BUT! THE EXCITEMENT AND CHALLENGES ARE SIMILAR TO THE DAWN OF COMPUTER LAB

AP SCI

THIS IS WHERE ACCELERATE COMES IN!

I WISH I COULD JUST TALK TO A HUMAN!

OUR CLINIC CAN HELP!

DATA COLLECTION

PRIVACY AND COMPLIANCE

ACCELERATE C2D3 FUNDING CALL 2023

UP TO £25K AVAILABLE!

£15K for Events and WORKSHOPS

1 YEAR TO COMPLETE

STRATEGY

Performance Metrics = CRITICAL

WHAT DOES AN AUTOMATED APPROACH NEED TO ACHIEVE OR BEAT?

Accuracy matters for coeliac disease! AND DIAGNOSIS IS NOT EASY BUT IT'S A LOW BAR TO BEAT!

AI OPPORTUNITIES

Molecular Organisation

Alzheimers Parkinsons

PHASE SEPARATION HOTSPOTS NOT AI/ML YET

There are things hidden in the neural network that we just don't understand!

DR. JANIN LAUTENSCHLAGER

PROTEIN PHASE SEPARATION AT THE SYNAPSE

FOCUS ON KEY AREAS

- Step change in use of AI at Cambridge
- Research Engagement Training
- Culture Change
- Strategic Collaboration

PROPOSAL WRITING

DATA PIPELINE

CLOUD DEPLOYMENT

PUBLISH AND PACKAGE MODEL

MODEL IMPLEMENTATION

HARDWARE GPU

Real World Development

Get help with EVENT PLANNING & TECHNICAL ASSISTANCE through the ML CLINIC

WE WANT TO SEE: new insights

MULTI-DISCIPLINARY TEAMS

RAPID SET-UP

THE CASE TO AUTOMATE APPROACH RESULTS

- 99% Benign
- Biopsies in low risk backlog
- Current accuracy is low

Classify tiles + Rank them

79% accuracy precision + recall

JESS MONTGOMERY

INTRODUCTION TO ACCELERATE

How to get in touch

online form

drop-ins

it's a match!

accelerate-mlc.cst.cam.ac.uk

KATIE LIGHT

PURSuing NOVEL APPLICATIONS OF AI FOR RESEARCH + INNOVATION

ELIZABETH SOILLEUX

AI IN PATHOLOGY: OPTIMISING A CLASSIFIER FOR DIGITAL IMAGES

THANKS ACCELERATE!

ACCELERATE C2D3 FUNDING CALL

DEADLINE - 5PM Friday 8th SEPT.

<https://acceleratescience.github.io>

Q+A - 21 June, 2-3pm William Gates Building

WHERE NEXT?

AI

RYAN DANIELS

HOW CAN THE MACHINE LEARNING ENGINEERING CLINIC SUPPORT YOU?

MIKE BOENO

Continue to Engage and Collaborate

CLOSING REMARKS

Continue to Engage and Collaborate

THESE CALLS ARE OFTEN A SPRINGBOARD TO OTHER FUNDING GRANTS!

FUNDING CALL