

CONNECT BASIC SCIENCE RESEARCH TO APPLICATIONS AND TRANSLATION WORKS

ecosystem, environment & conservation

CAN AI MAKE LIFE CHEAPER OR MORE EXPENSIVE?

HELPING ROBOTS SENSE THE WORLD!

FIND NEW EXPLODING STARS!

AUTOMATE the ROUTINE

inspecting LARGE VOLUMES of information

HELP PREVENT ILLEGAL WILDLIFE TRADE

POACHING

MACHINE LEARNING

IS THE NEW HAMMER FOR THE COMPUTATIONAL SCIENTIST!

DISCOVER UNEXPECTED CONNECTIONS...

FIND NEW MATERIALS

FIND NEW DRUGS

AND HELP TACKLE CLIMATE CHANGE!

RENEWABLE ENERGY OPTIMISATION

WHAT COULD AI HELP US ACHIEVE IN SCIENCE?

improve access to EVIDENCE!

A COMMUNITY WITH CRITICAL MASS WILL SET THE STANDARDS WE NEED!

MORE TALKING, SHARING AND OUT-OF-COMFORT COLLABORATIONS BETWEEN EXPERTS OF VARIOUS DOMAINS...

eliminate the bias towards white male technocrats

WE NEED AI WE CAN Trust

get rid of OUTDATED METRICS!

JUST BECAUSE YOU CAN USE A COMPLEX METHOD... DOES IT MEAN YOU SHOULD?

WHAT DO WE NEED TO HELP US ACHIEVE THIS VISION?

funding...

AND NOT JUST FOR THE 'COOL' PROJECTS - FOR THE MOST IMPACTFUL WORK, TOO.

think BEFORE YOU COMPUTE

MULTIDISCIPLINARY COLLABORATION is KEY for AI science!

you CAN'T outcompute bad DATA

DON'T BLINDLY APPLY ML/AI TO EVERYTHING... What do you want to achieve? What role do human scientists play?

the more explainable your model, the more people engage!

WHAT ROLE CAN THE CAMBRIDGE COMMUNITY PLAY?

personalised education POWERED BY AI/LLM's

DON'T LET AI TAKE any volunteers? THE WORK HUMANS WANT, OR THE TASKS WHICH ALLOW US TO BE CREATIVE!

AI needs YOU! TRAINING OPPORTUNITIES FOR PEOPLE FROM DIFFERENT BACKGROUNDS

DEMISTIFYING LLM's and making them EASILY AVAILABLE

HELPING AI UNDERSTAND DATA THAT ISN'T NICELY LABELLED... NATURE DOESN'T WORK LIKE THAT!

AI COULD HELP SOFTWARE PUMP BLOOD ROUND THE BODY WITH AN ASD

CAMBRIDGE CAN Pave the Way FOR A SYSTEM OF SUSTAINABLE COLLABORATION

CONNECTING EXPERTS ACROSS THE GLOBE!

connecting AI RESEARCHERS with RESEARCHERS THAT USE AI

NEW INSIGHTS FROM TRAJECTORY ANALYSIS ACROSS THE LIFECOURSE

Bringing us all together like this, from physicists to medics to conservationists, to learn how AI is used in different fields is so helpful!

BIDIRECTIONAL FLOW OF IDEAS BETWEEN AI FOR SCIENCE & THE SCIENCE OF AI

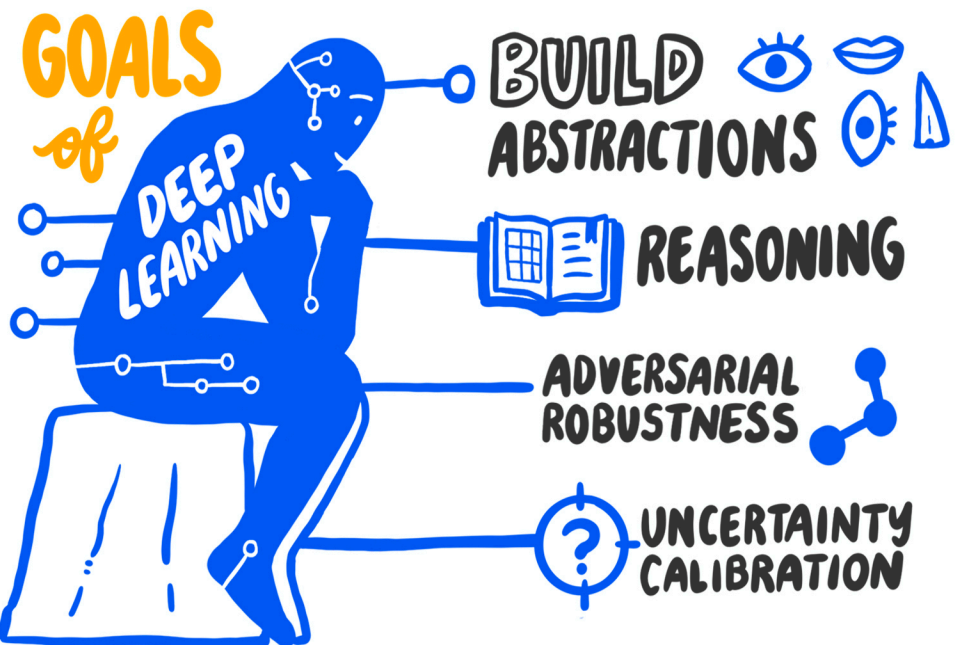
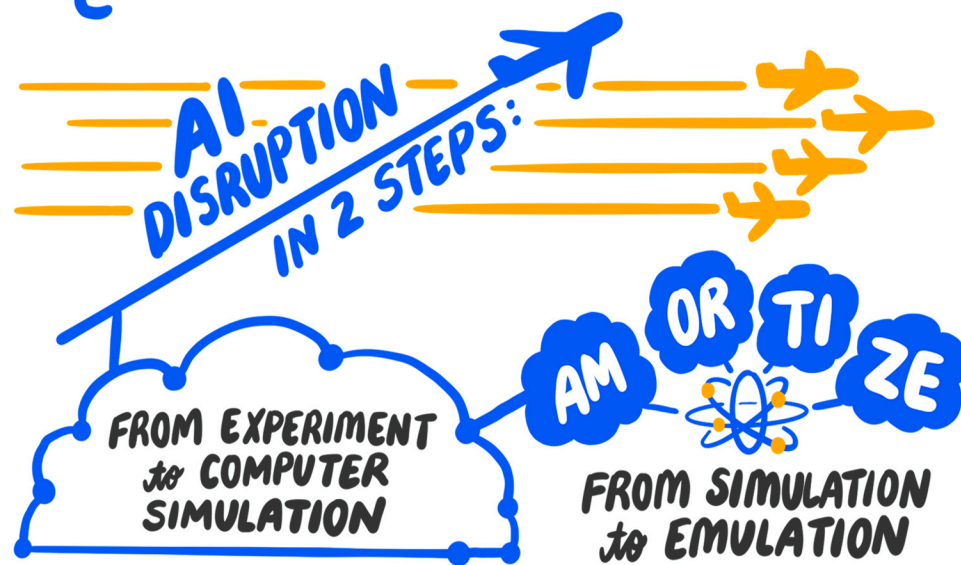
BETTER EVALUATIONS AND BENCHMARKS TO ENSURE OUR RESULTS ARE ROBUST!

AI in the HUMAN LOOP, not the other way around!

A MORE DYNAMIC VIEW OF DEEP LEARNING

WITH THE EMERGENCE OF...
AI
 SOMETHING IS SHIFTING IN SCIENCE

DRUG DISCOVERY: GENERATING MOLECULES
CATALYSIS: ACCELERATE REACTIONS
MATERIAL SCIENCES
 AND MORE! (GENAI, ALPHAFOLD)



WE NEED A MORE DYNAMIC VIEW of ML:

ML IS the NEW HAMMER for...
 COMPUTATIONAL SCIENTISTS

OSCILLATORS
 TRAVELLING WAVES
 SYNCHRONISATION

AI FOR SCIENCE SUMMIT

DAY 1: 25/11/24

USE of EXPLAINABLE ML MODELS IN METABOLIC MEDICINE

SUPERVISED learning MODELS to PREDICT BMI

RANDOM FOREST MODEL to IDENTIFY IMPORTANT FACTORS IN OBESITY

CLEAR EXPLAINABLE MODELS & VISUALISATIONS

RECURRENT VAE with GAUSSIAN PROCESS DECODERS

WE NEED to FIND the BEST WAY to REPRESENT MOLECULES SO THAT THEY'RE MACHINE READABLE

E.G. MOLECULAR PROPERTY LANDSCAPE

Unravelling the string theory landscape

WE DON'T KNOW the DEFINITION of STRING THEORY

USE ML to APPROXIMATE this GEOMETRIC LANDSCAPE!

NOWCASTING the ILLEGAL WILDLIFE TRADE

IT'S A THREAT to WILDLIFE & HUMANS

USE GAUSSIAN PROCESSES to UNDERSTAND NOISY DATA & MAKE PREDICTIONS

GENE REGULATORY DYNAMICS IN CELL STATE TRANSITIONS

UNDERSTAND DYNAMICS IN CELL POPULATIONS

FLOW-BASED MODELS to PREDICT

DISCOVERING ELECTROCHEMISTRY with ELECTROCHEMISTRY-INFORMED NEURAL NETWORKS

BIG DATA IS NOT the ONLY DATA for ML

USE ELECTRO-CHEMICAL PRINCIPLES to INFORM OUR NEURAL NETWORK

ECINN

TITLE: FIRST STEPS USING TOPOGRAPHIC DEEP NEURAL NETWORK MODELS IN the VENTRAL STREAM

NEURAL NETWORKS CAN PREDICT NOVEL BRAIN REGION SPECIALISATION VIA TOPOGRAPHIC CLUSTERING

PERSON
BIKE

THERE IS NO LIMIT to HOW MUCH ENERGY NUCLEAR FISSION CAN CREATE

CONTROL is NEEDED!

APPLICATION of AI/ML IN NUCLEAR

micro REACTORS ARE THE AIM FOR NUCLEAR POWER

RL AUTONOMOUS CONTROL COULD HELP ACHIEVE THIS!

DISENTANGLED MULTIMODAL REPRESENTATION MODELS IN HEALTHCARE

ECG TEST
MRI SCAN

PINPOINT SHARED INFO between DATA SOURCES

MULTIMODAL REPRESENTATION LEARNING CAN GIVE A UNIFIED VIEW of A PATIENTS' HEALTH

USING COHORT DATA to EXPLORE HEALTH & DISEASE

JOINT EFFORT

PROVIDED ORGANISED, TOP-LEVEL METHODS

CLINICAL RESEARCH
TRANSLATIONAL RESEARCH

GROWTH CHARTS for LUNG DEVELOPMENT ARE IMPORTANT!
 7YO

COLLECTING DATA REPEATEDLY (OVER 50-60 YEARS) ALLOWED US TO BETTER UNDERSTAND COPD

LUNG HEALTH STARTS AT YOUTH!

AI HAS POTENTIAL, BUT IS NOT ENTIRELY TRUSTWORTHY

WE NEED TO BUILD...

- FEEDBACK LOOPS
- OPEN NETWORKS
- SHARE RESULTS!

OUR ASPIRATIONS for AI IN SCIENCE

HOW to EVALUATE AI MODELS:
 PROPERLY TEST the MODELS!
 & FINE TUNE THEM

WE NEED to COLLABORATE

THINK ABOUT the LEGACY of the WORK WE LEAVE BEHIND!

JUSTIFY BENCHMARKS

AI for DATA-DRIVEN STR & PHYSICS

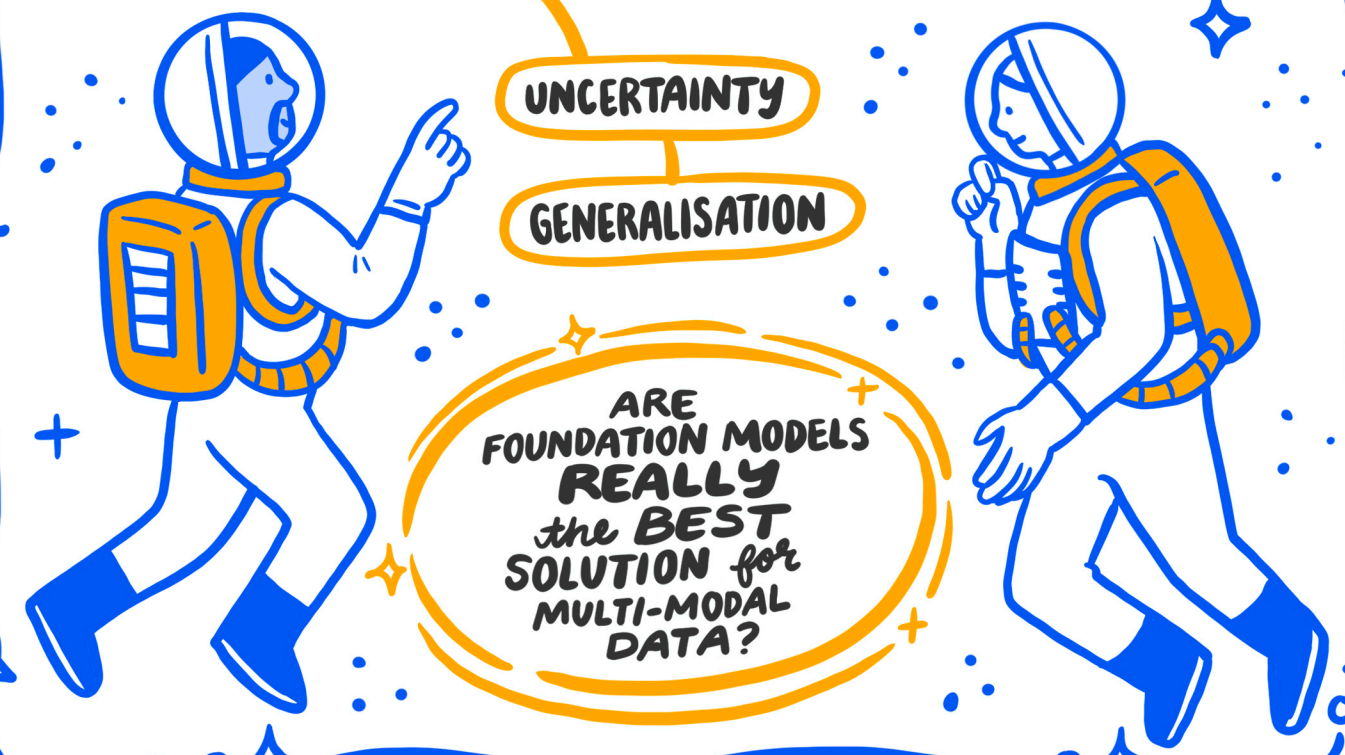
AI FOR SCIENCE SUMMIT

DAY 2: 26/11/24

WHAT COULD **UNLOCK** A STEP-CHANGE IN AI FOR SCIENCE?

ASTRONOMY DATA ISSUES:

- LARGE ARCHIVAL DATABASES, BUT SMALL LABELLED DATASETS
- CAREFULLY CALIBRATE UNCERTAINTIES
- VARIABLE CLASS IMBALANCES
- BIASES IN MODELS
- FOUNDATION MODELS: BEST "OWNED" by SAME COLLABORATIONS that OWN the DATA
- MULTI-MODAL MODELS
- HIGHLY SPECIFIC USE CASES!
 - ↳ ASTROCLIP
 - ↳ ASTROM3
- REQUIRES BETTER VERIFICATION of OUTPUTS!



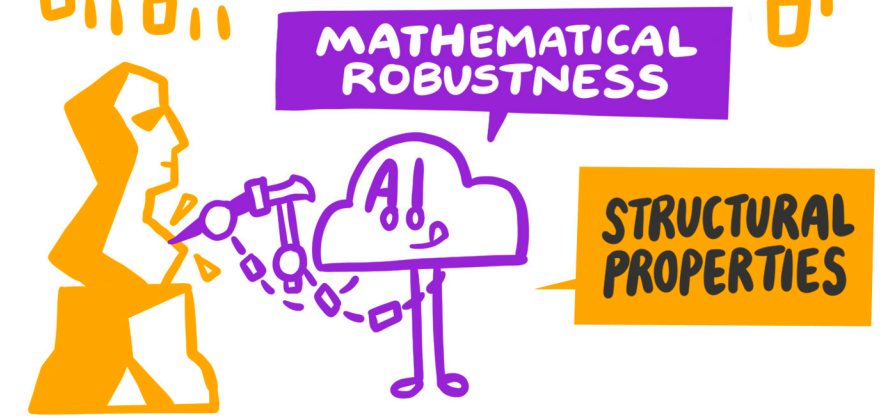
AI for IMAGING

FROM DIFFERENTIAL EQUATIONS TO DEEP LEARNING for IMAGES

EXCITING APPLICATIONS!

- REMOTE SENSING
- VIRTUAL ART RESTORATION
- BIOMEDICAL: SPATIO-TEMPORAL MRI
- MODELLING PROTEIN DYNAMICS
- TRAFFIC MANAGEMENT
- DIAGNOSIS/PROGNOSIS

DEEP LEARNING REVOLUTION CALLS for NEW APPROACHES & ASSOCIATED MATHEMATICS



LIMITATIONS & DANGERS of DEEP LEARNING

- BIAS
- UNEXPLAINABILITY
- UNPREDICTABLE behaviour

improved REPEATABILITY

DIVERSITY

WE NEED CONTINUITY



HOW DO WE EVALUATE the OUTPUTS?

CREATE A framework THAT HELPS!

WE NEED to CREATE TOOLS that WORK!

BUILDING COMMUNITY & INSTITUTIONAL CAPABILITY

MORE SUPPORT for RSEs IN ACADEMIA

CHANGE the WAY WE WORK TOGETHER!



ACCELERATE PROGRAMME FOR SCIENTIFIC DISCOVERY

Scriberia