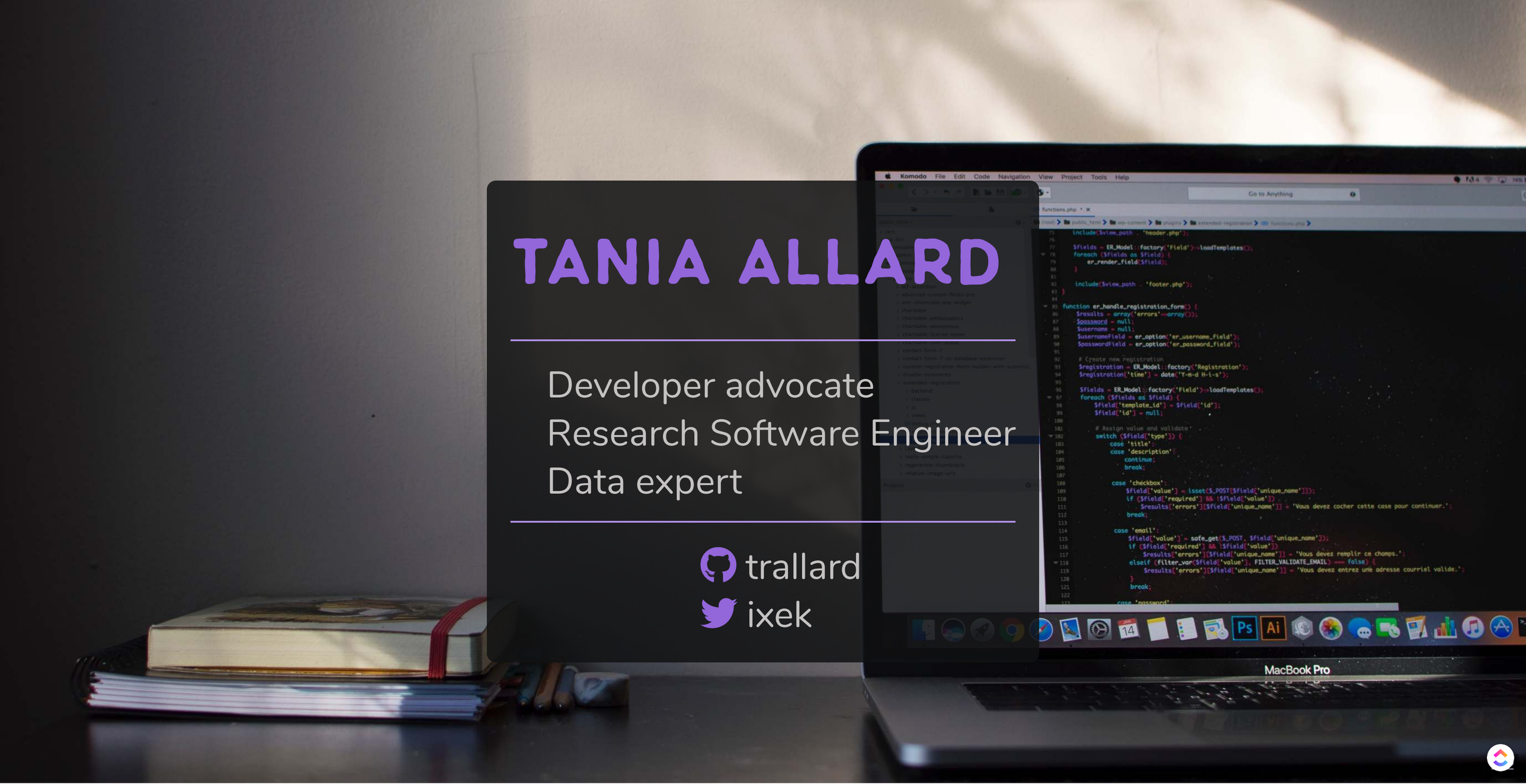

TUX

https://trallard.github.io/Talks/RSE-sheffield

THE STATE OF MACHINE LEARNING

RSE seminar, University of Sheffield

Tania Allard, PhD



TANIA ALLARD

Developer advocate
Research Software Engineer
Data expert

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MACHINE LEARNING EVERYWHERE

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MACHINE LEARNING EVERYWHERE

So much that it is starting to not make sense anymore... like when you say a word 50 times in a row

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For good or for bad it is everywhere:

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For good or for bad it is everywhere:

- Deployed in healthcare and warfare

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For good or for bad it is everywhere:

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- In the creative industry (from music to books)

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For good or for bad it is everywhere:

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- In the creative industry (from music to books)
- Reading CVs and judging your creditworthiness

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For good or for bad it is everywhere:

- Deployed in healthcare and warfare
- In the creative industry (from music to books)
- Reading CVs and judging your creditworthiness
- Making us more Instagram worthy

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The big players:

- Apple
- Facebook
- Google
- IBM
- Intel
- Microsoft
- Nvidia
- Open AI
- Twitter

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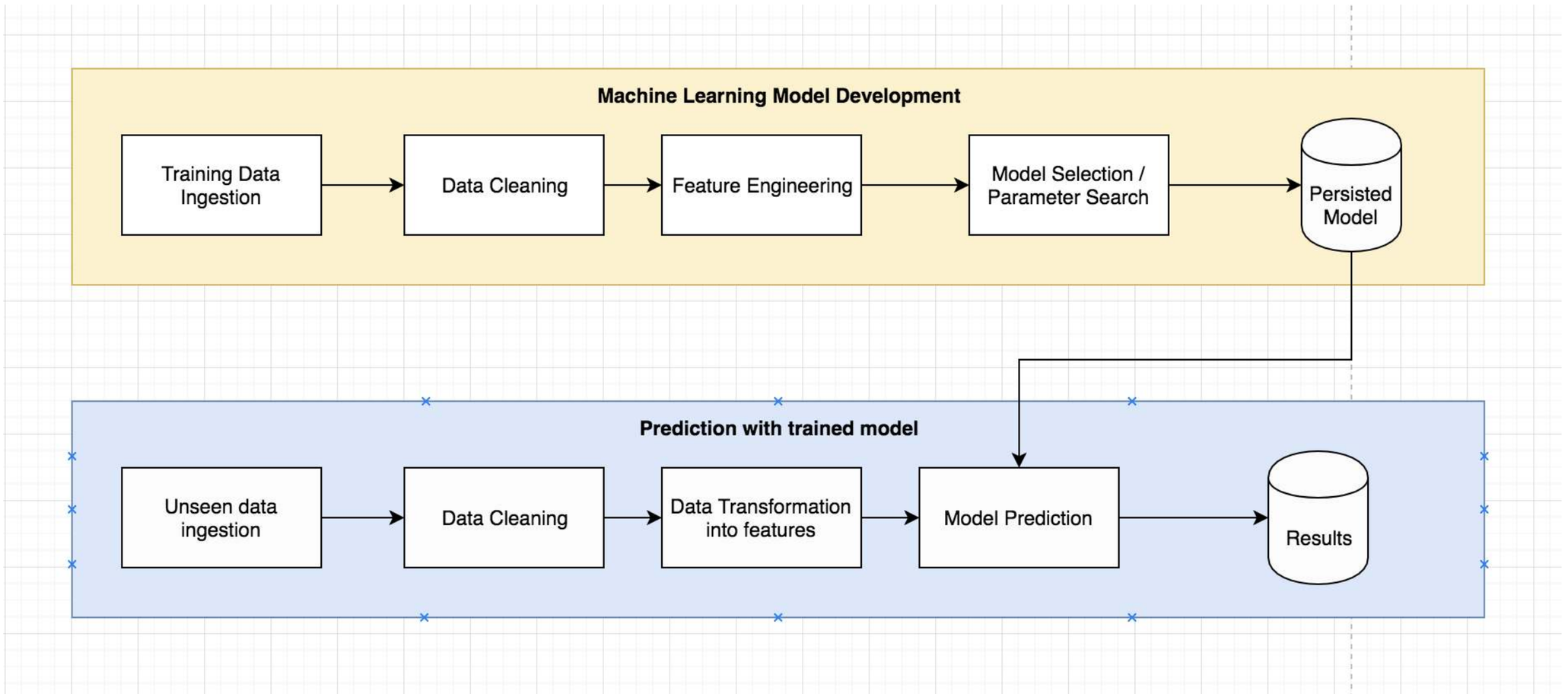
MACHINE LEARNING GENERALISED IN TWO WORKFLOWS

- Model development (R&D)
- Model serving (production for customers consumption)


Machine Learning Model Development
Training Data Ingestion
Data Cleaning
Feature Engineering
Model Selection / Parameter Search
Persisted Model
Prediction with trained model
Unseen data ingestion
Data Cleaning
Data Transformation into features
Model Prediction
Results

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WHAT ARE THESE GIANTS' ISSUES?

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WHAT ARE THESE GIANTS' ISSUES?

Mainly scale...in multiple areas

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If we have a small team we have a smaller number of issues... right?

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- Small number of models to maintain

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If we have a small team we have a smaller number of issues... right?

- Small number of models to maintain
- People have the knowledge in their heads
- They have their own methods to track progress

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THAT IS THE SMALL TEAM PERFORMANCE FALLACY

We still need processes and best practices in place... so let me get back at this later

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AS THE TEAM DEMAND GROWS THE PROBLEMS GROW

- Increased complexity of data flow
- Larger number of workflows
- Managing complexity of flows and scheduling becomes a nightmare
- Resource allocation has to be on point

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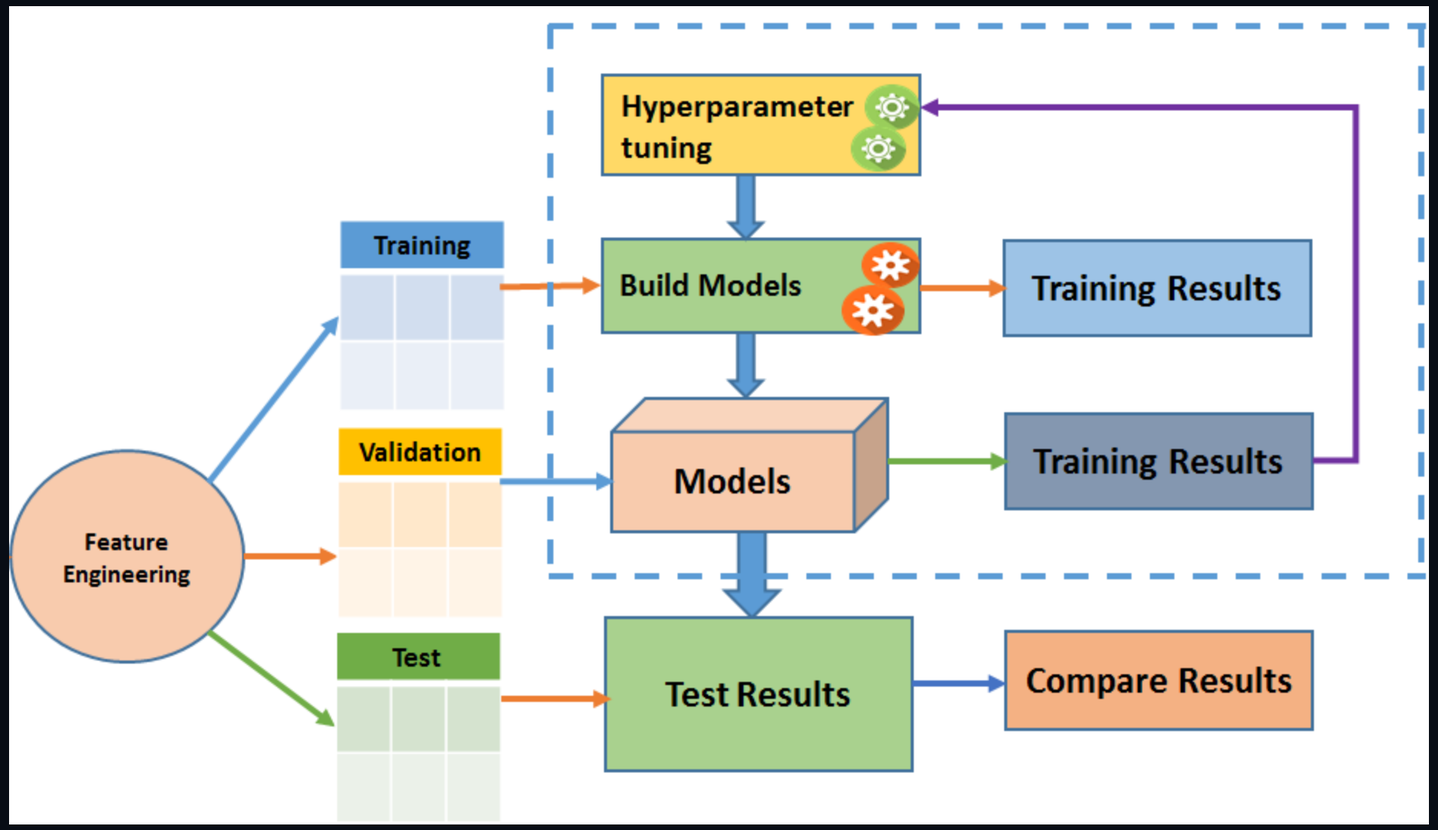
SERVING MODELS BECOMES HARDER



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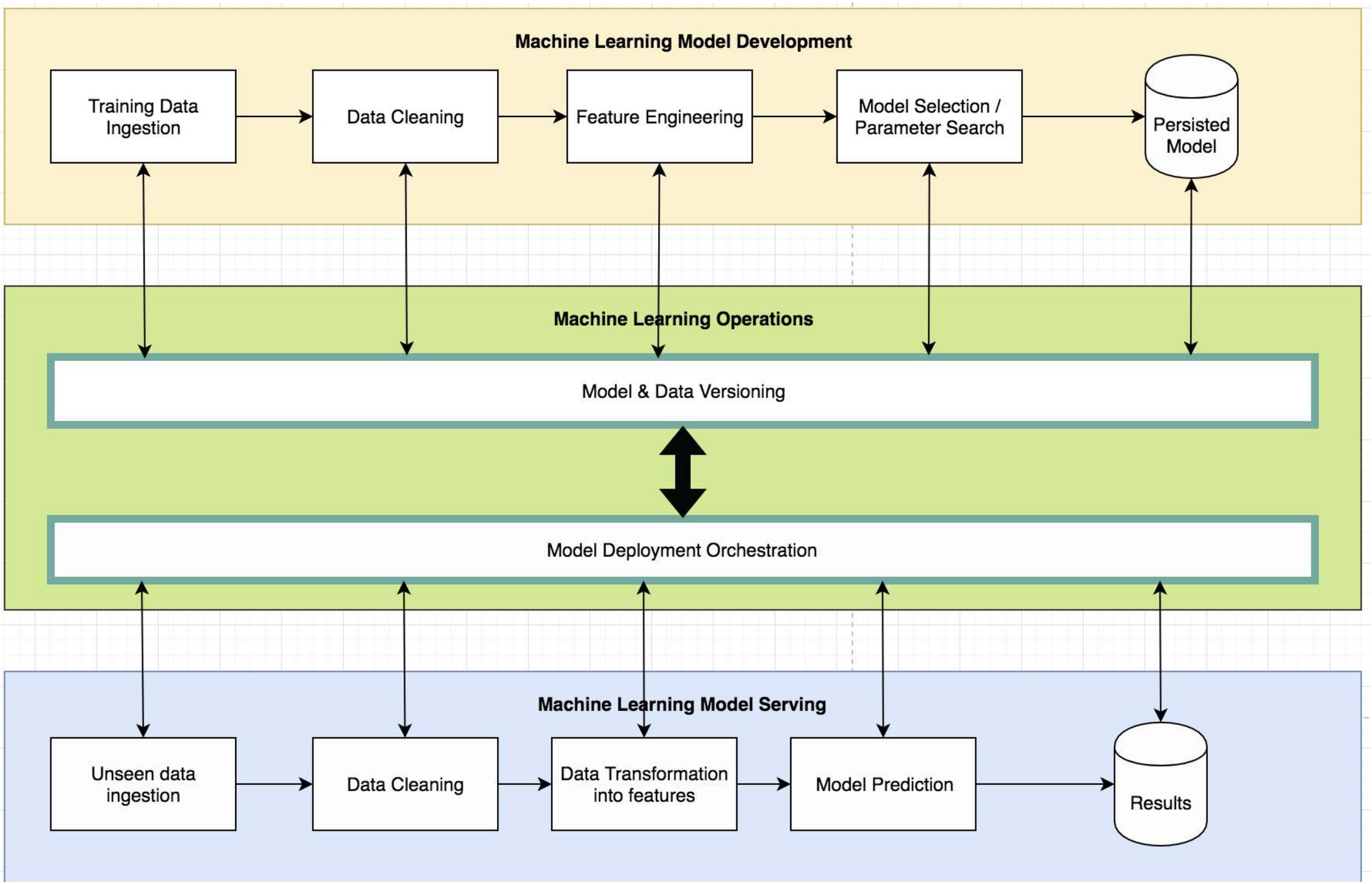
Machine Learning Model Development
Training Data Ingestion
Data Cleaning
Feature Engineering
Model Selection / Parameter Search
Persisted Model
Machine Learning Operations
Model & Data Versioning
Model Deployment Orchestration
Machine Learning Model Serving
Unseen data ingestion
Data Cleaning
Data Transformation into features
Model Prediction
Results

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HOW DO THEY SERVE MILLIONS OF

CUSTOMERS ACROSS THE GLOBE?

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Three main players:

- Infrastructure / resources
- Processes
- People

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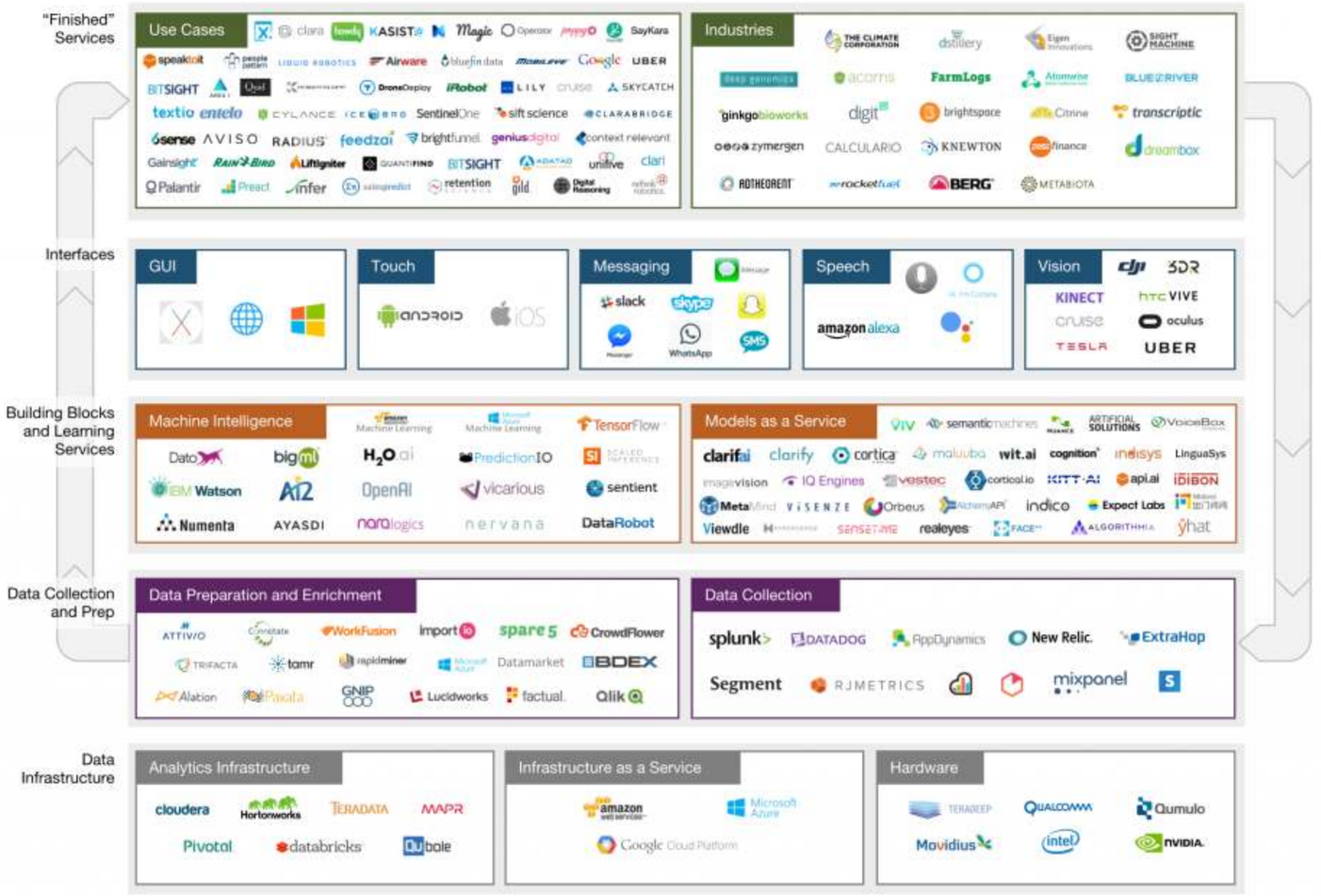
Intelligent App Stack



Created by @MattMcIlwain, @TmPorter, @SSomasegar, @DanielxLi

MADRONA VENTURE GROUP

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Analytics & Machine Learning

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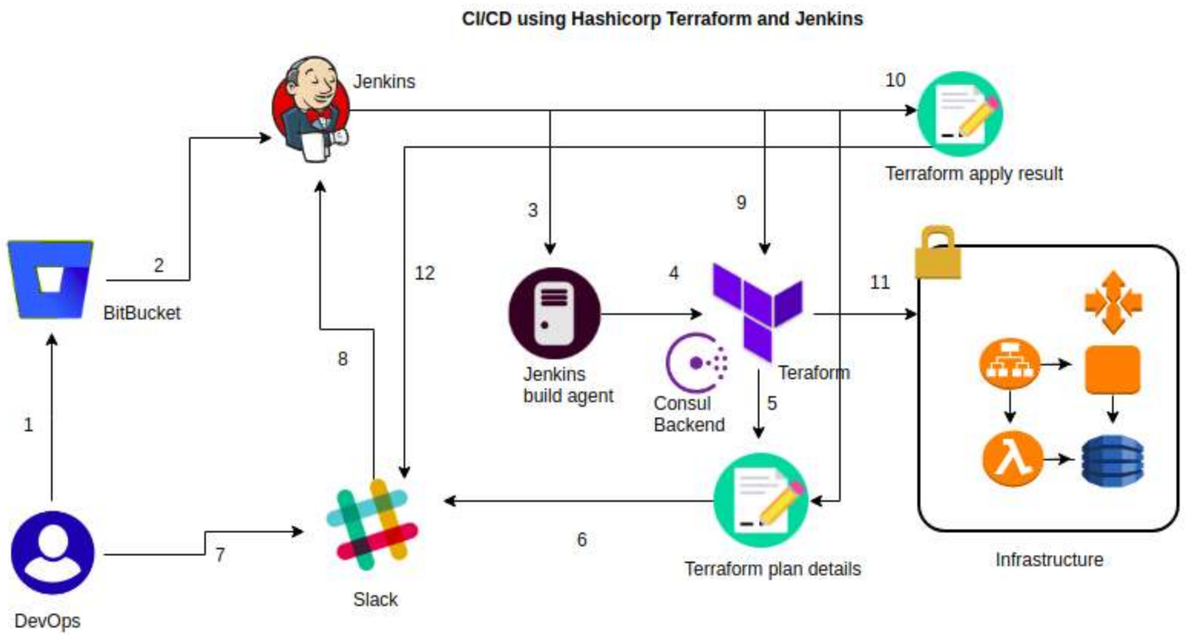
INFRASTRUCTURE AS A CODE



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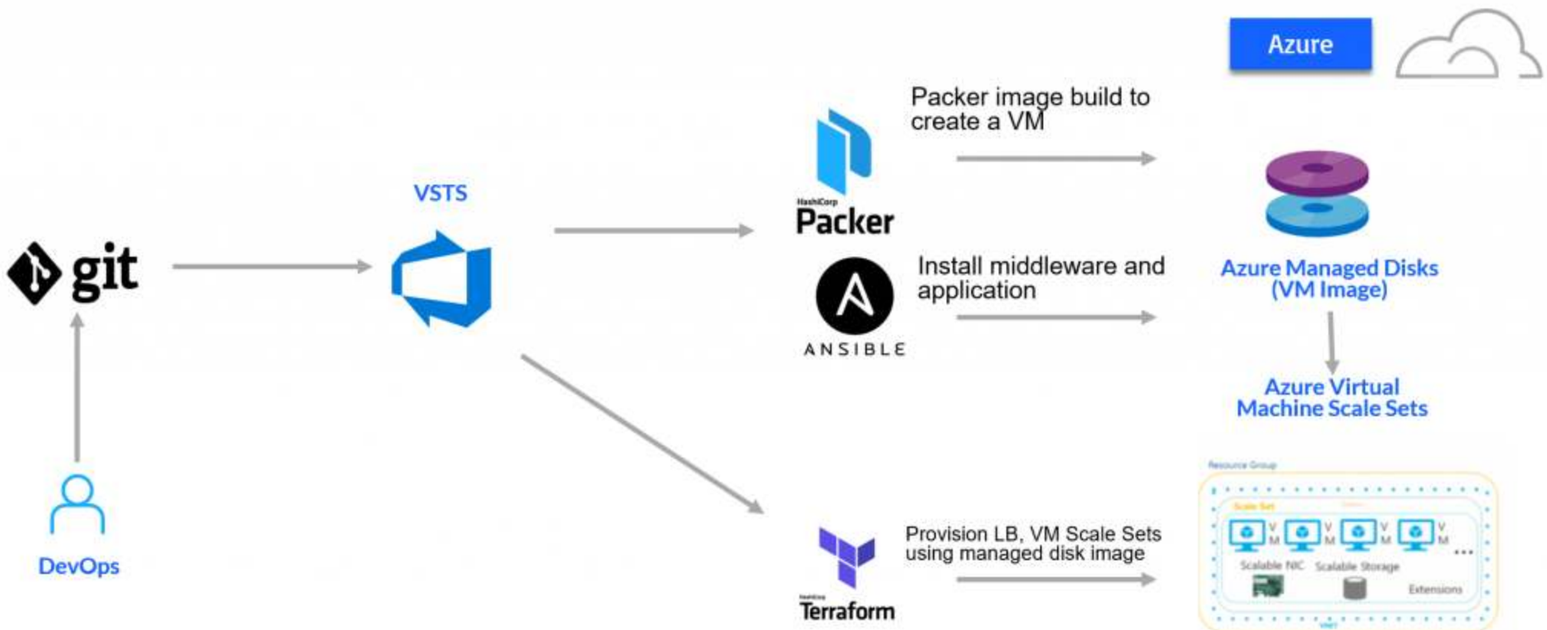
Azure
Packer image build to create a VM
VSTS
Packer
Install middleware and application
ANSIBLE
Azure Managed Disks (VM Image)
Azure Virtual Machine Scale Sets
git
DevOps
Provision LB, VM Scale Sets using managed disk image
Terraform
Scalable NIC
Scalable Storage
Extensions

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EVERYTHING AS A CODE

- Version control
- Less ambiguity on the configurations
- Shorter turnarounds
- Deterministic environments

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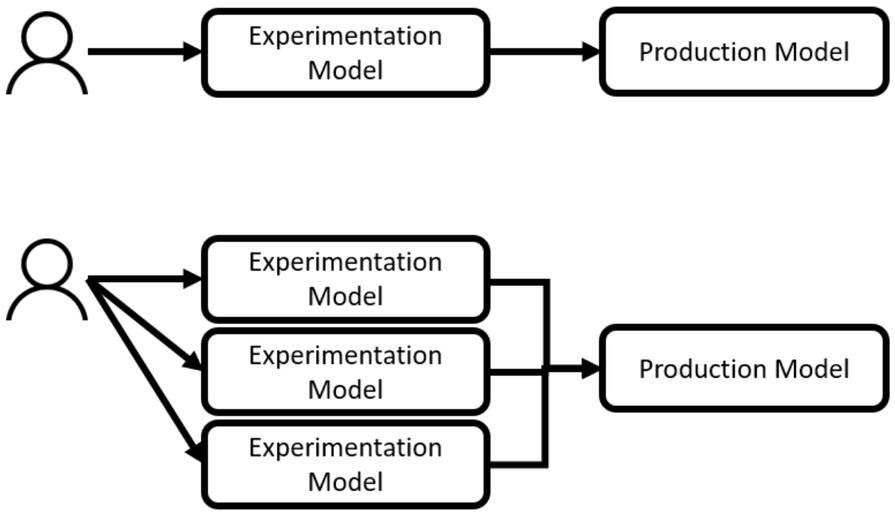
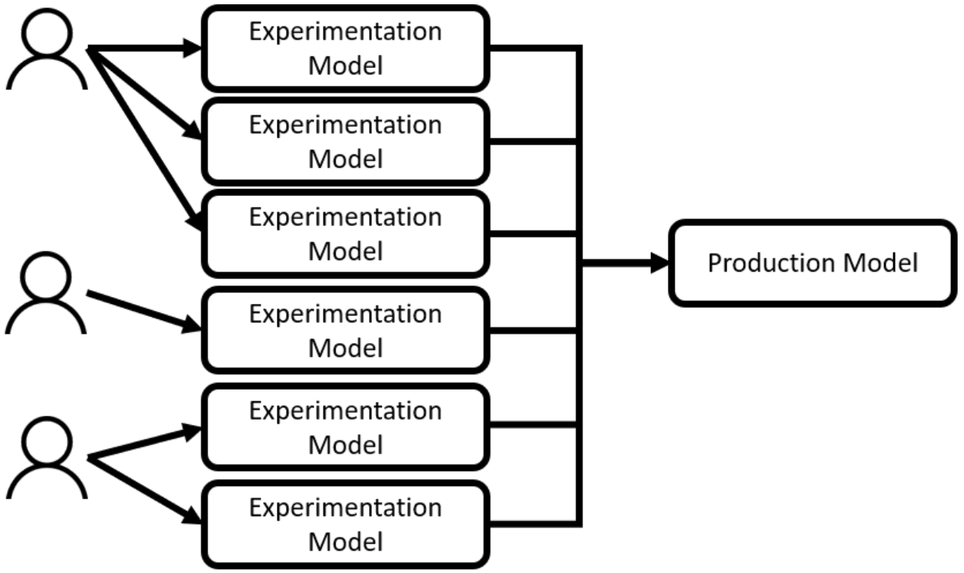
PROCESSES





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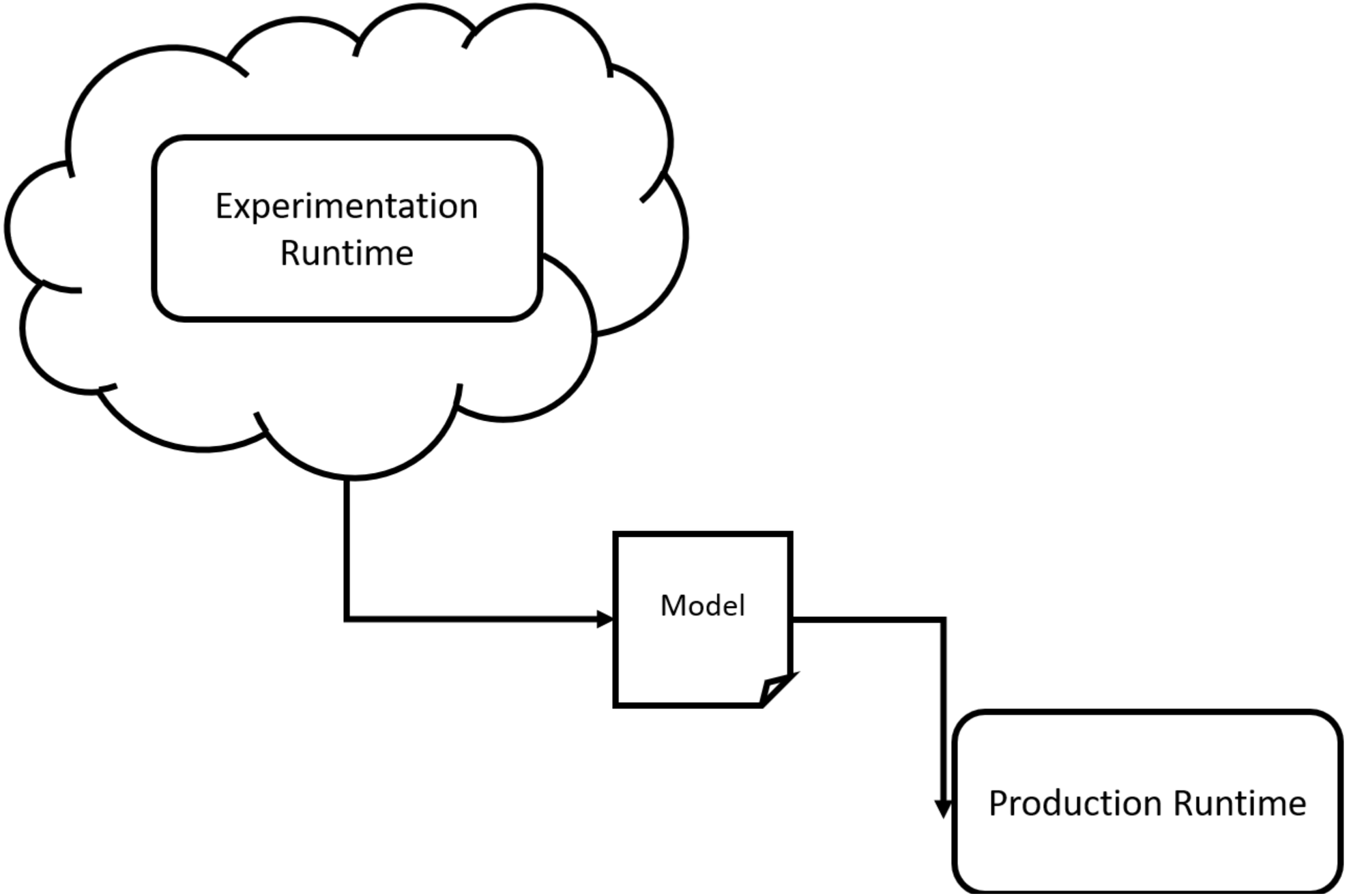
Experimentation Runtime
Model
Production Runtime

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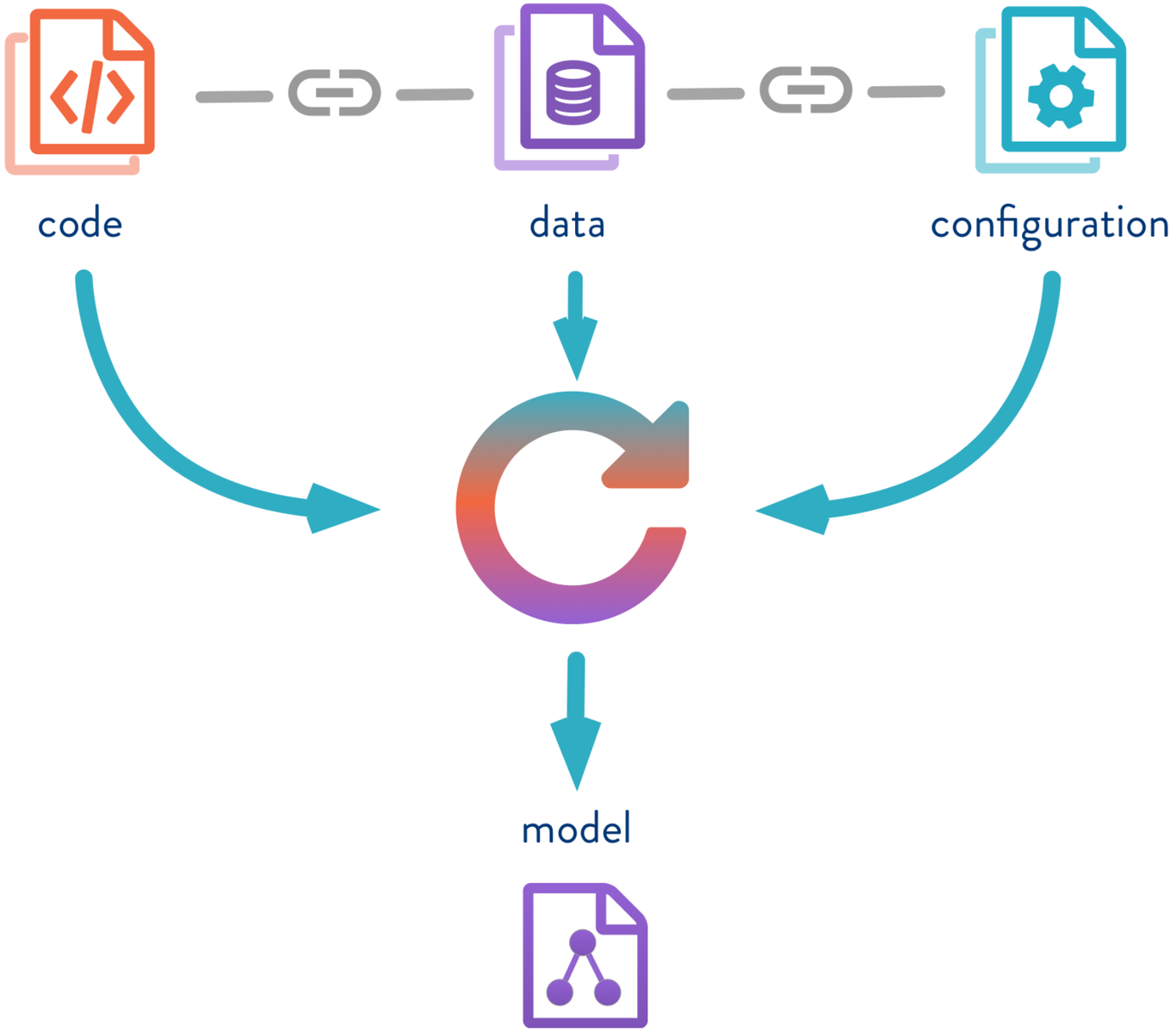
DATA AND CODE AS FIRST CLASS CITIZENS


code
data
configuration
model

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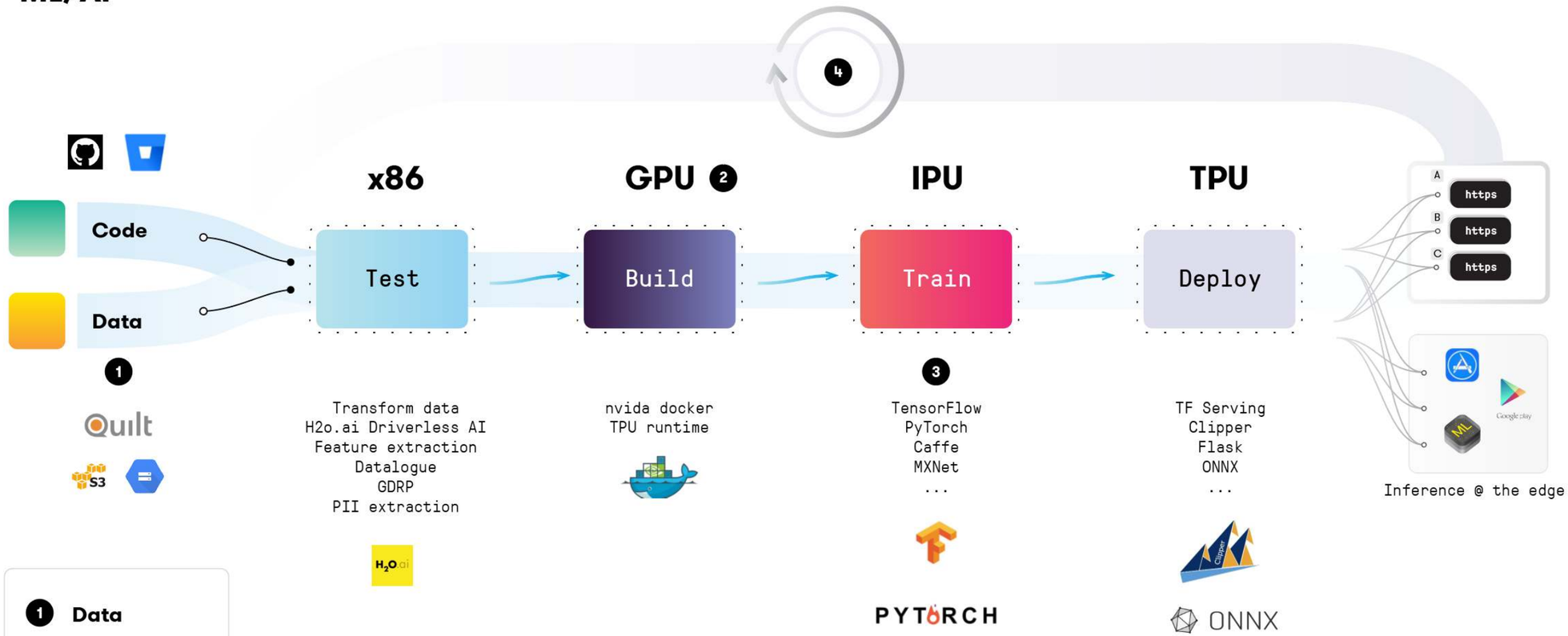
ML/AI



1. Data
2. Accelerators
3. Train step
4. Refitting

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PEOPLE

- Data scientist
- Data engineer
- ML Engineer

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WHAT DOES ACADEMIA HAVE TO OFFER?

Much more than you think

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PEOPLE

- Researchers
- Research software engineers
- Librarians

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RESOURCES AND INFRASTRUCTURE

We still need to figure this out... it is pretty much an ad-hoc case

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PROCESSES

- Scientific rigour
- Peer review
- Data management

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WHICH AREAS COULD BENEFIT FROM ACADEMIC COLLABORATIONS?

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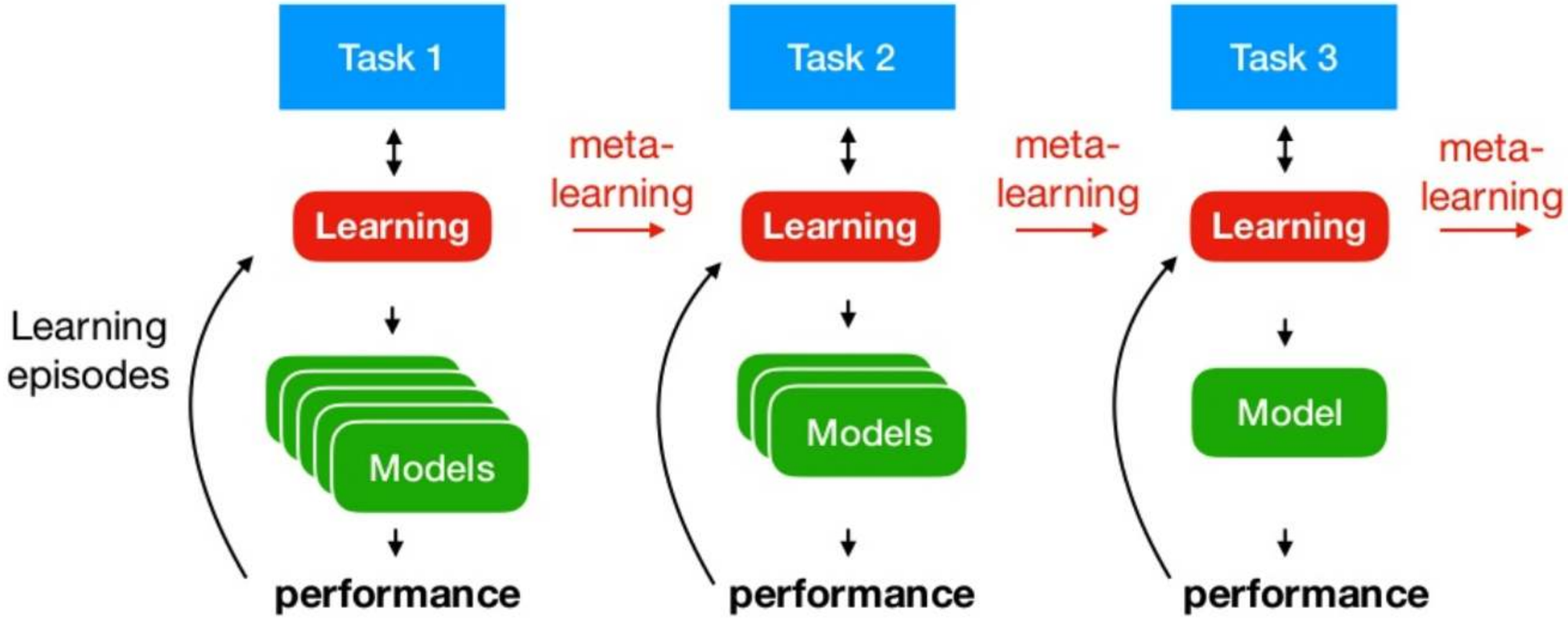
META-LEARNING

Humans learn across tasks (learn from experience)


Task 1
Learning
Models
performance
Learning episodes
meta-learning
Task 2
Learning
Models
performance
meta-learning
Task 3
Learning
Model
performance
meta-learning

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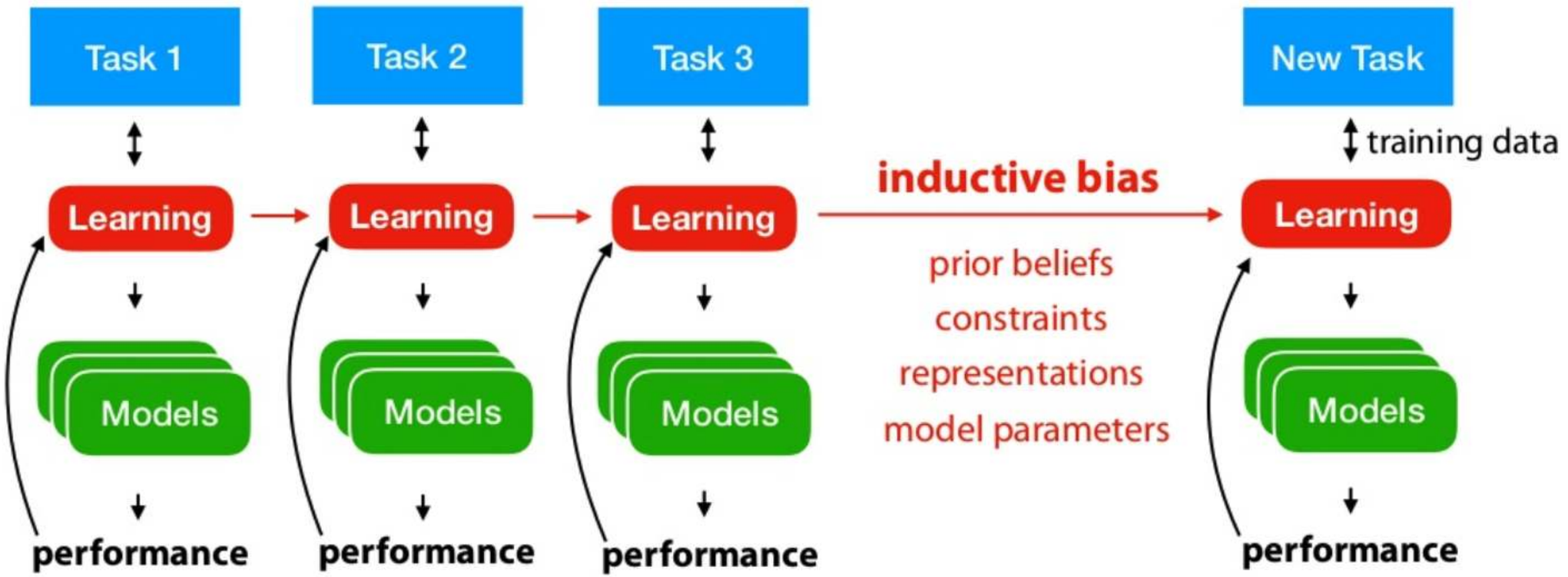
If prior tasks are similar then we can carry prior knowledge



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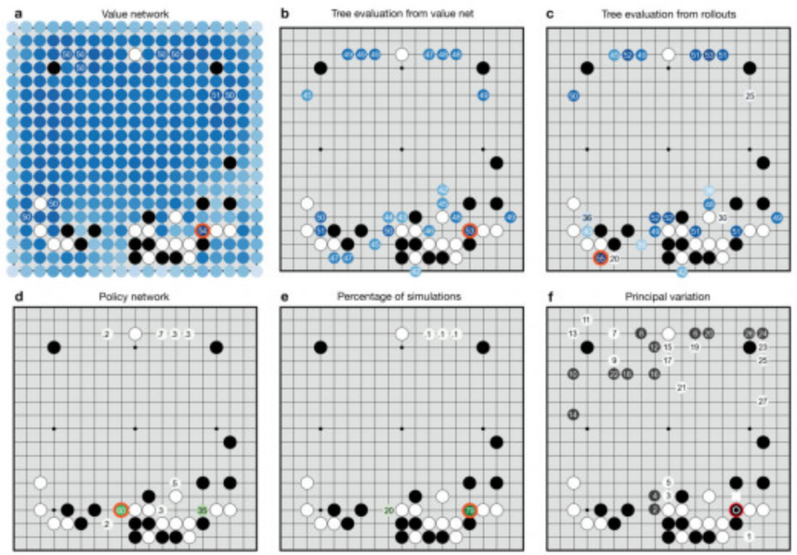
AlphaGo uses some sort of meta-learning



AlphaGo

AI RESEARCH .COM

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ALGORITHMIC FAIRNESS

It has become increasingly important to ensure that models are making justified calls that are free from unintended bias.

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ALGORITHMIC FAIRNESS

It has become increasingly important to ensure that models are making justified calls that are free from unintended bias.

The one way to make progress is through interdisciplinary collaboration

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TOWARDS MODEL EXPLAINABILITY

Address the trade-off between performance and interpretability

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REINFORCEMENT LEARNING DEADLY TRIAD

Following nature's paradigms RL agents receive awards and then learn to maximise success by performing optimal actions.

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How to keep an algorithm learning if there are far too many potential variables or outcomes to be evaluated without being fed ridiculous amounts of data.

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IN BRIEF

Focus on the 3 pillars:

- People
- Infrastructure
- Processes

THANK YOU

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