Inteligencia Artificial

en la academia y la industria

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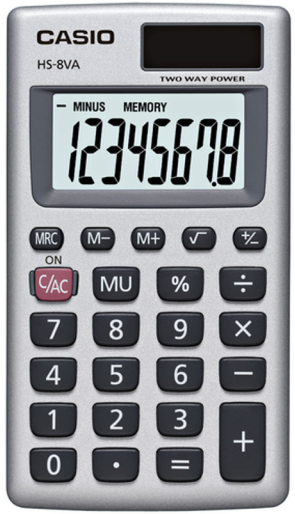
frontier x analytics

NASA FRONTIER DEVELOPMENT LAB

esa

tiene IA?


BIRD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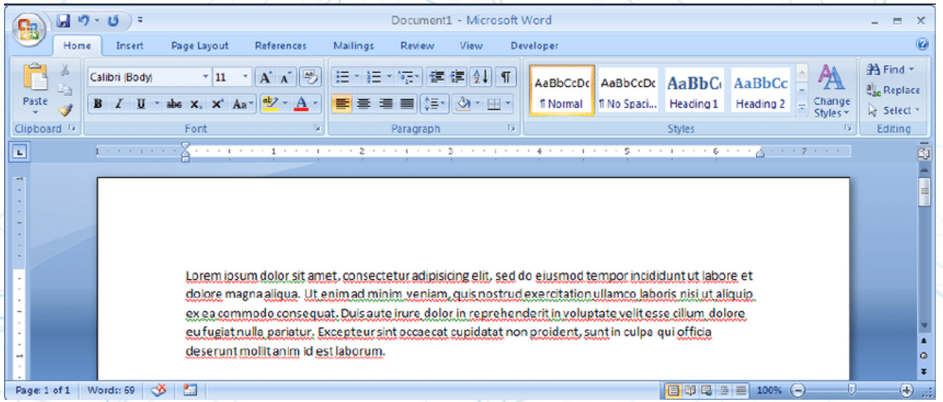
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AI according to Wikipedia

“Colloquially, the term "artificial intelligence" is often used to describe machines (or computers) that mimic "cognitive" functions that humans associate with the human mind, such as "learning" and "problem solving".”

Inteligencia Artificial según Wikipedia

A medida que las máquinas se vuelven cada vez más capaces, tecnología que alguna vez se pensó que requería de inteligencia se elimina de la definición. Por ejemplo, el reconocimiento óptico de caracteres ya no se percibe como un ejemplo de la «inteligencia artificial» habiéndose convertido en una tecnología común.[3] Avances tecnológicos todavía clasificados como inteligencia artificial son los sistemas de conducción autónomos o los capaces de jugar al ajedrez o al Go.[4]

General AI

A machine capable of do what humans

Conscious machines

Narrow AI

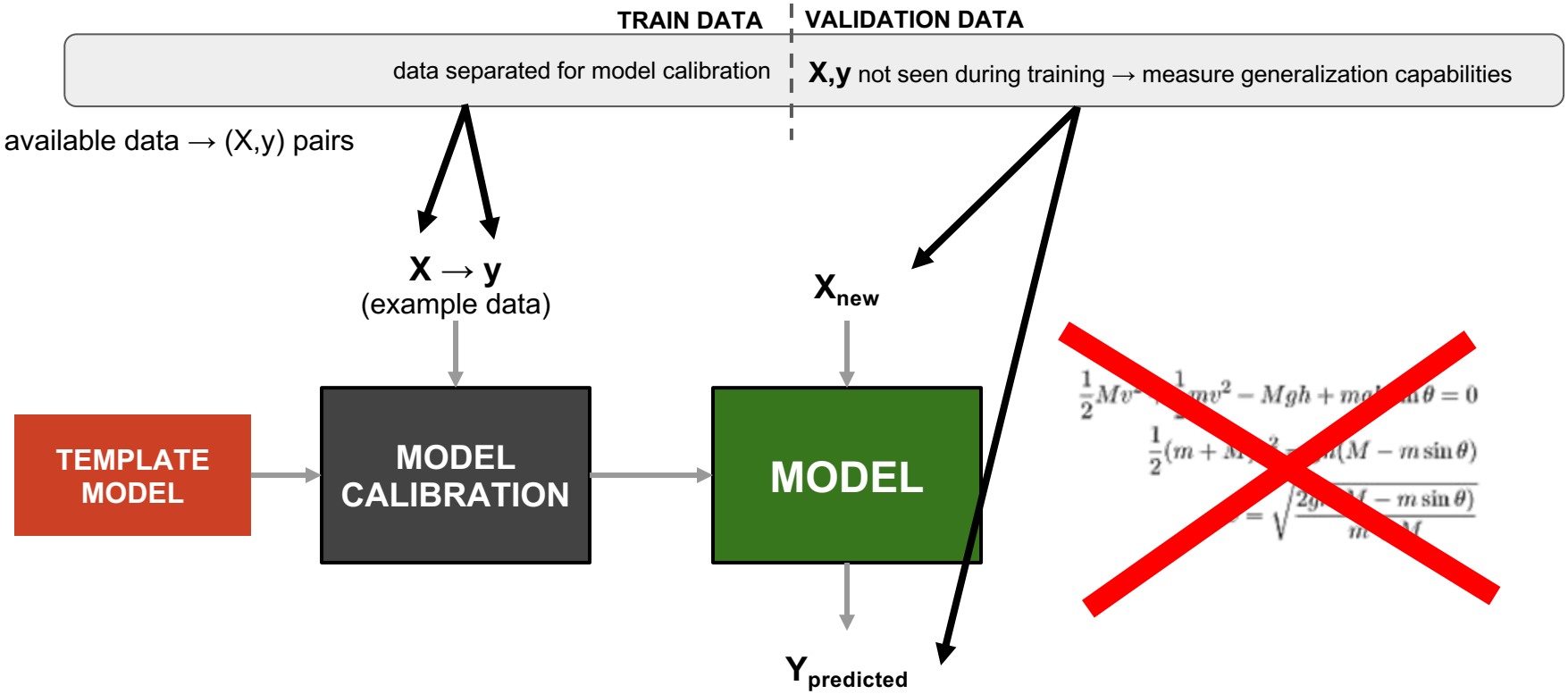
Solve field specific problems

Take advantage of existent data

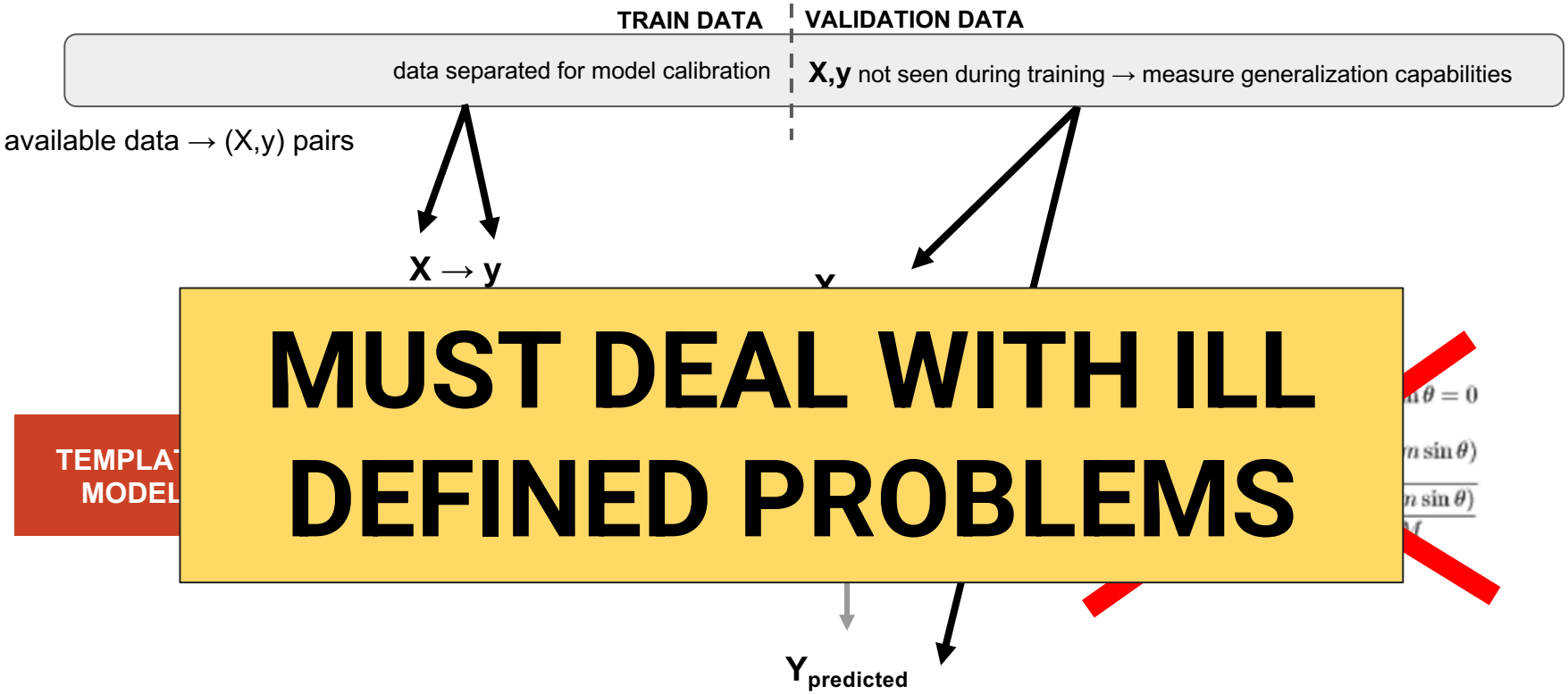
Correlate multiple source

Combine Low Level and high level information

data science machine learning big data business intelligence data mining

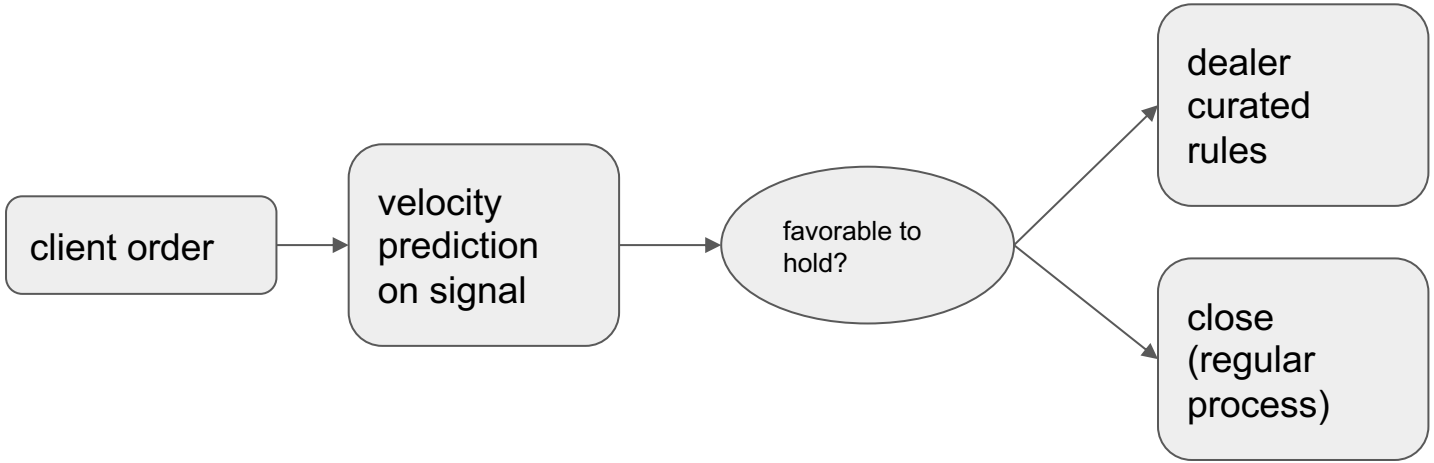


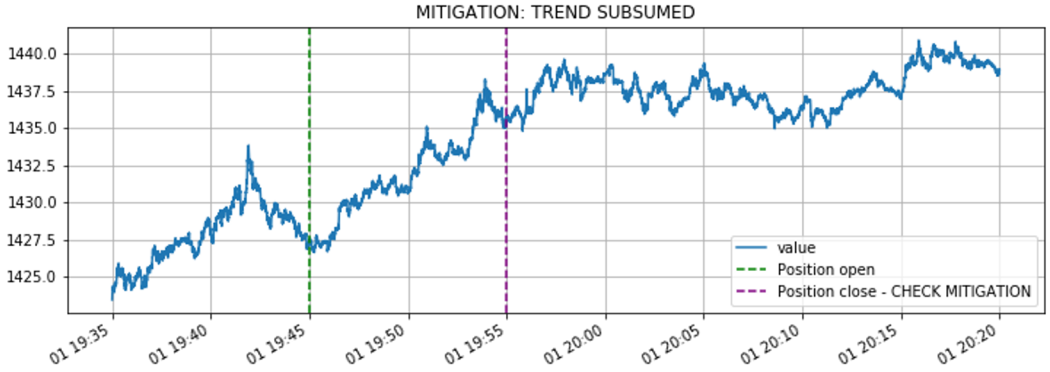
Performance in train (calibration)	BAD	GOOD	GOOD
Performance in validation (generalization)	**BAD**	**GOOD**	**BAD**



Performance in train (calibration)		GOOD	GOOD
BAD			
Performance in validation (generalization)	**GOOD**	**BAD**	
BAD			

Hedging strategies on commodities





HSS AI ASSISTED TRADING STRATEGY - details - from simulation 2019 data

AI MODEL trained with 10 hours of previous data
retrained every 10 min to adjust to new trends

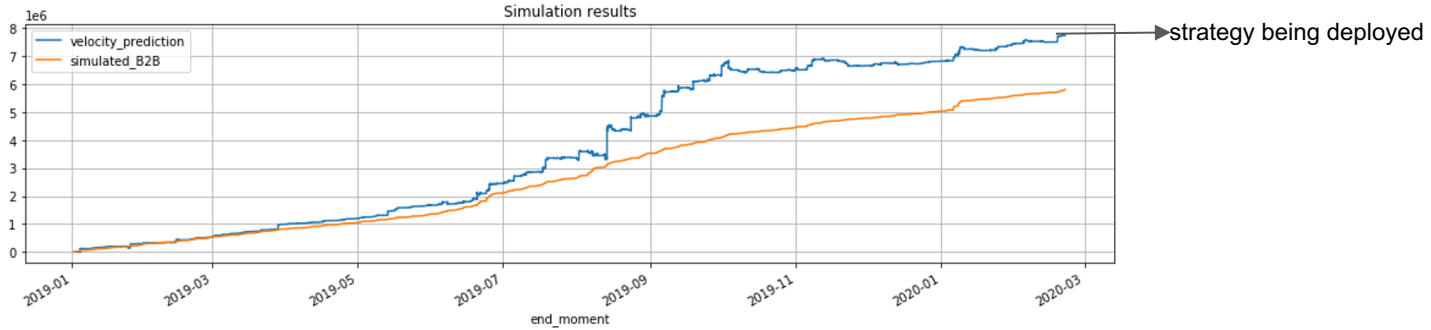
MOMENTUM is VELOCITY on statistically smoothed signal on [-35mins, +35mins]

TRAILING STOP trailing stop = current spread percentile wrt historic / 10
Current spread percentile = 15 → trailing stop = 15/10 → trailing stop = 1.5

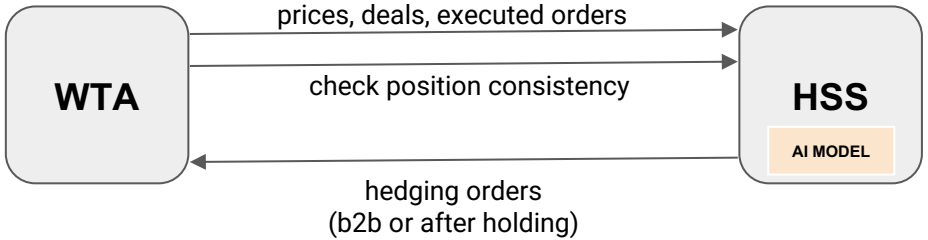
VOLATILITY as standard deviation 10 mins before

MOMENTUM ZERO is interval (-1.85, 1.85) USD/hour

all parameters tuned with simulations on data 2019-2020



WTA control on HSS, custom protocol



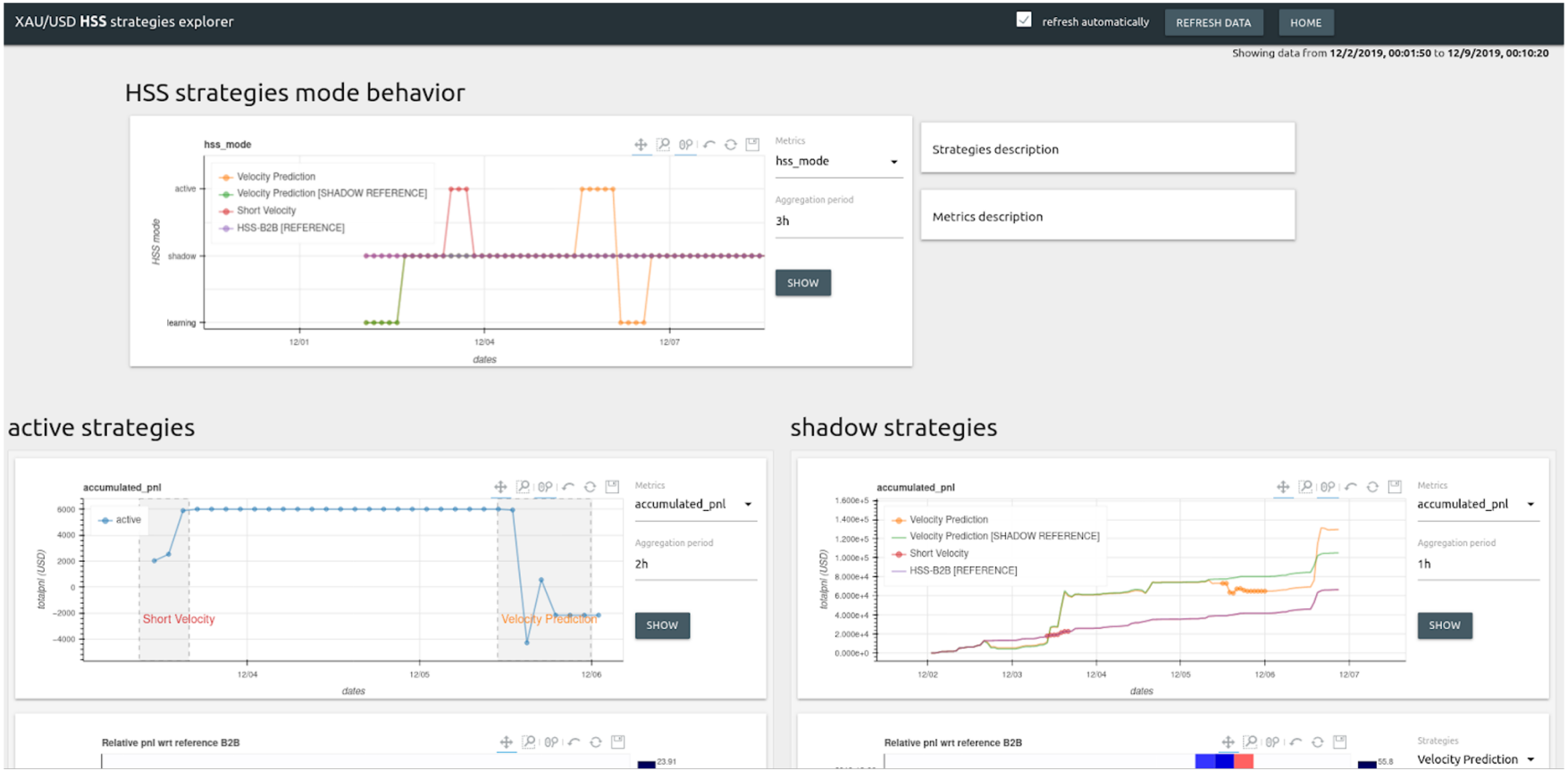
WTA checks regularly that
→ HSS is alive and responding timely
→ HSS keeping track of **position** is consistent

If checks fail → **switch to WTA4 BACK 2 BACK automatically which will close any open position**

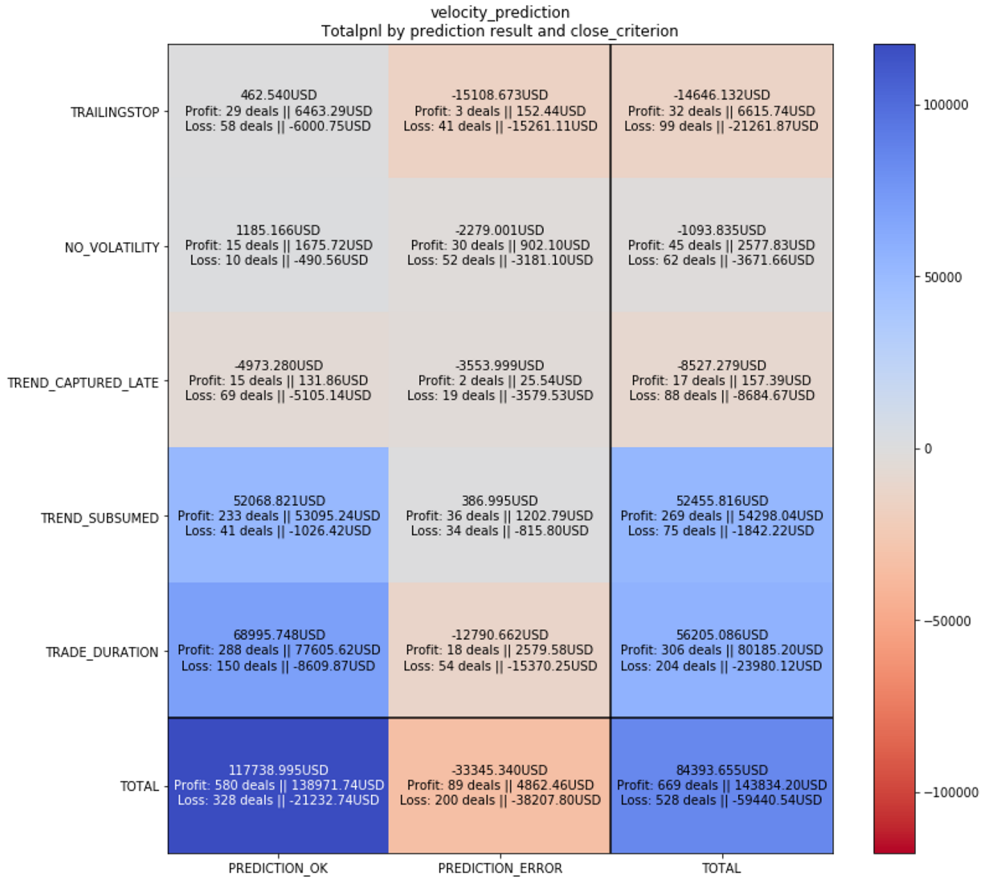
> min val

WTA reports back to HSS on order executions
(slippage, rejections)

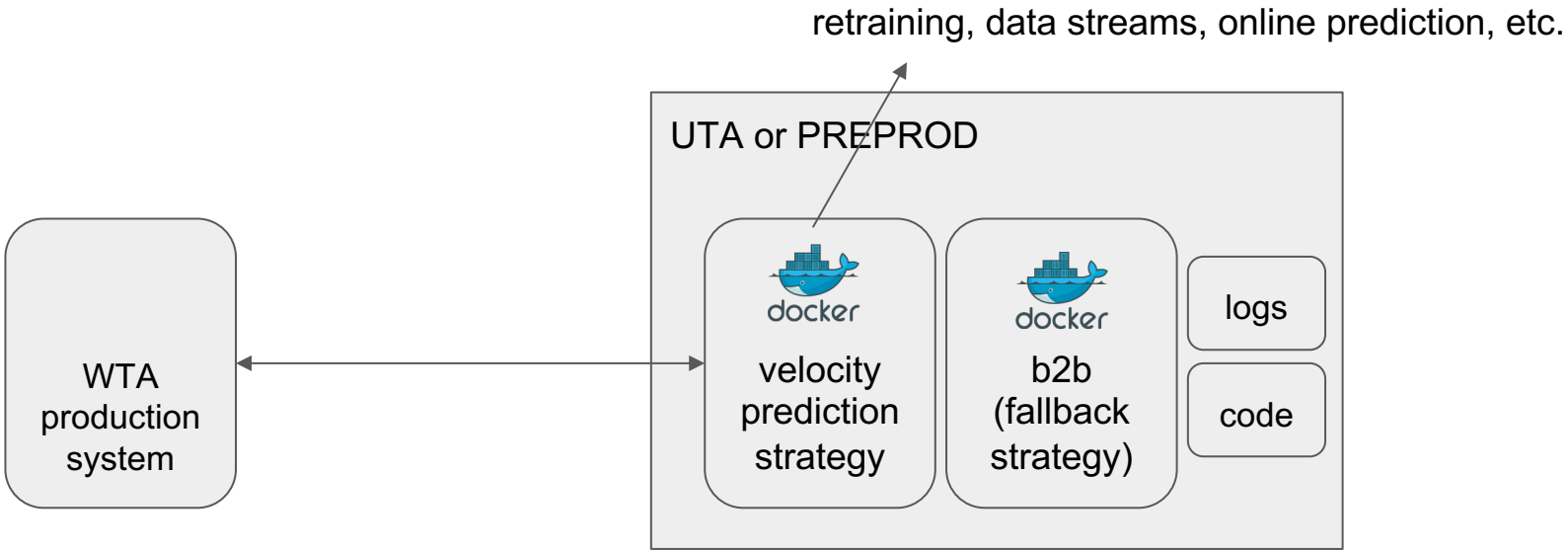
ONLINE TRACKING DASHBOARD



OFFLINE ANALYSIS



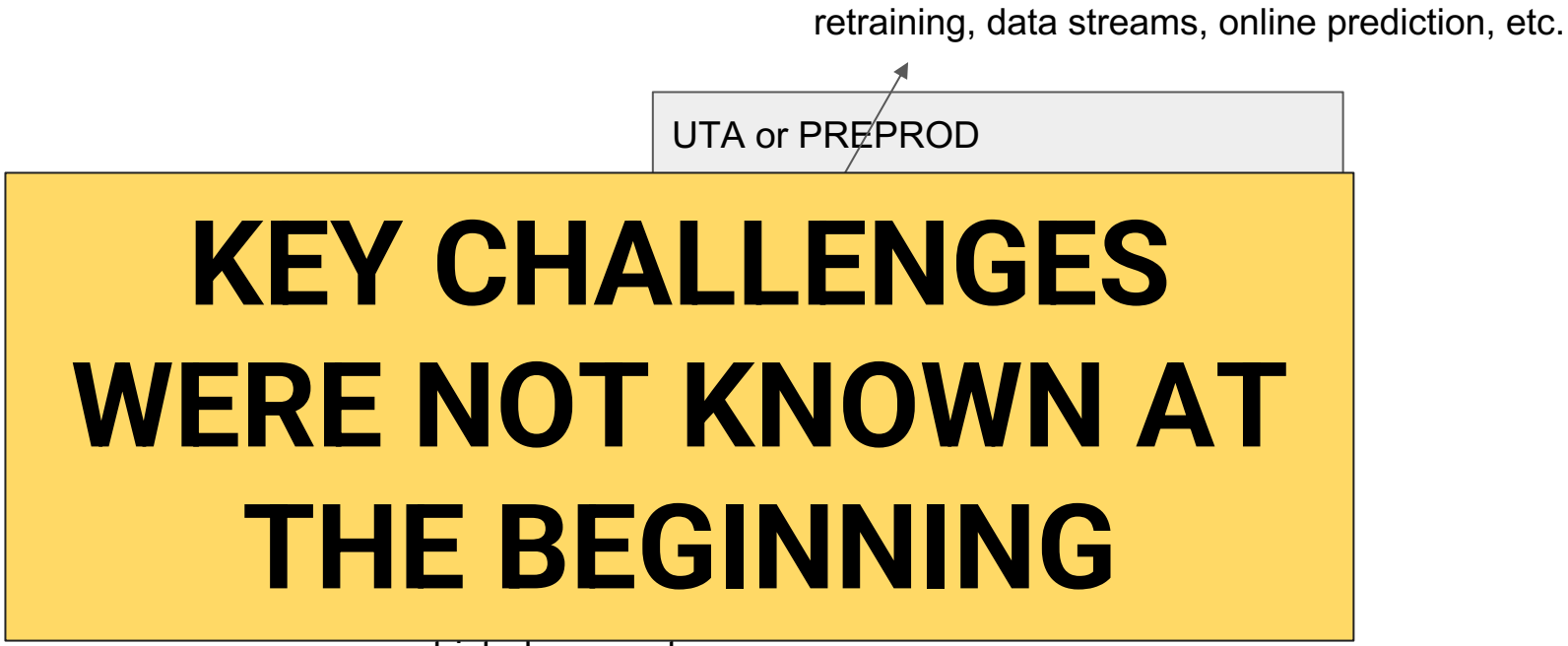
Deployment, deployment, deployment



deployment IS THE MAYOR technical challenge

- restricted access to envs
- real time prediction → optimization of code
- very long trial+error cycle
- +6 months delays
- interruptions by maintenances, etc.
- need to develop tools to enable **agile** process

Deployment, deployment, deployment



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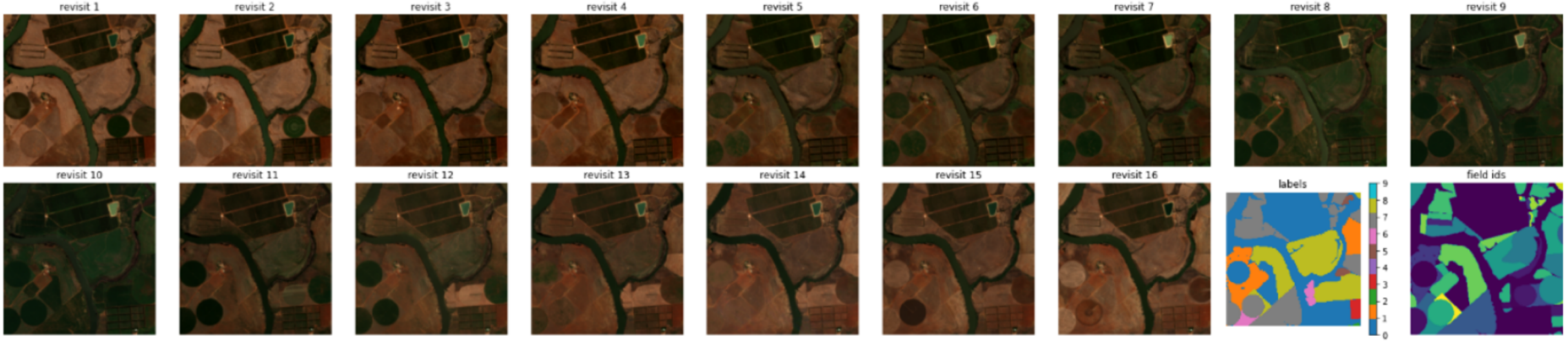
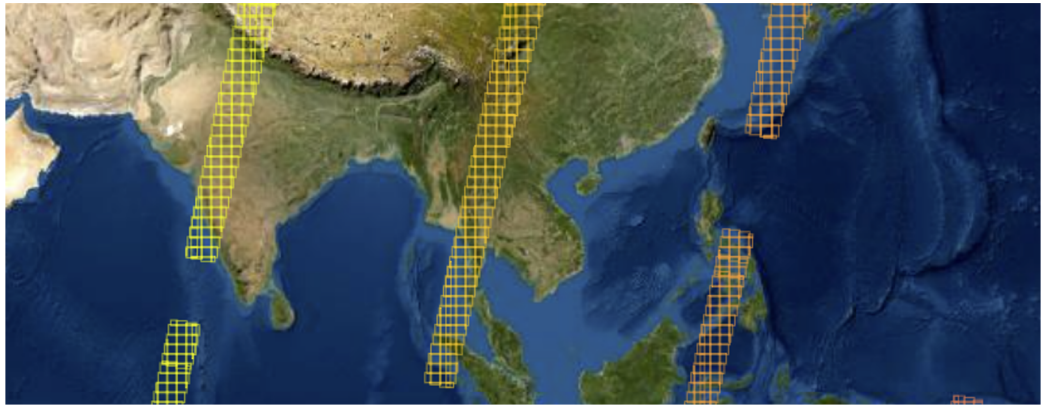
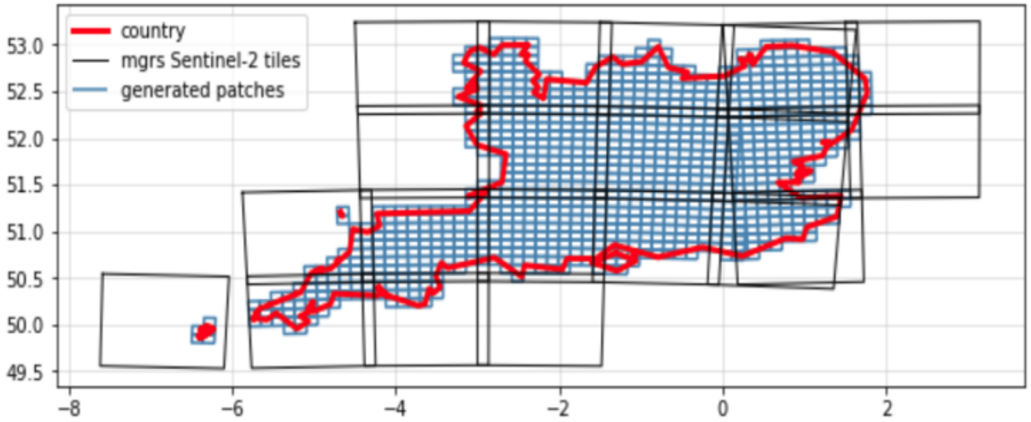
FDL NASA/ESA Self Supervised learning for World Food Programme

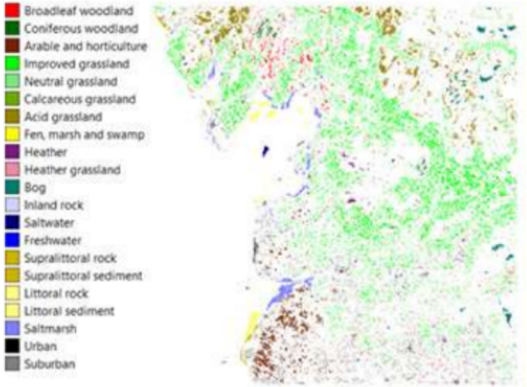


crop detection? yield prediction? field segmentation?

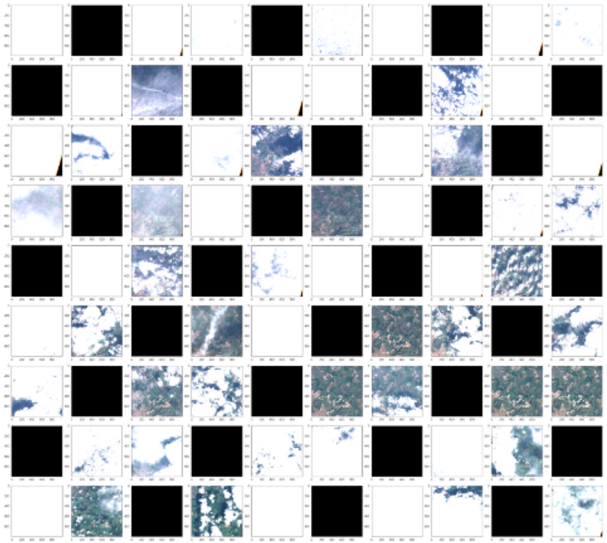
FDL NASA/ESA Self Supervised learning for crop detection

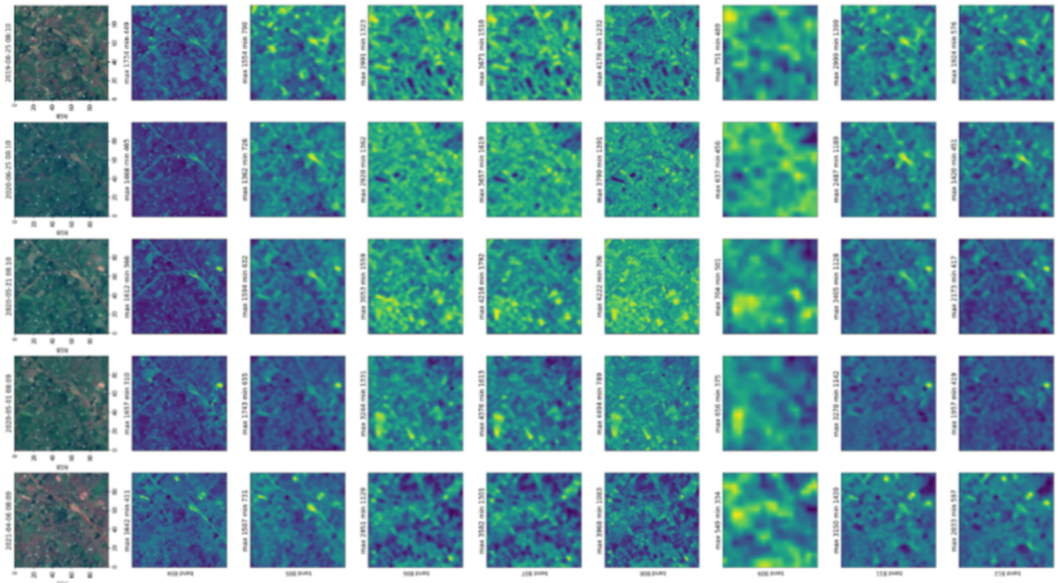






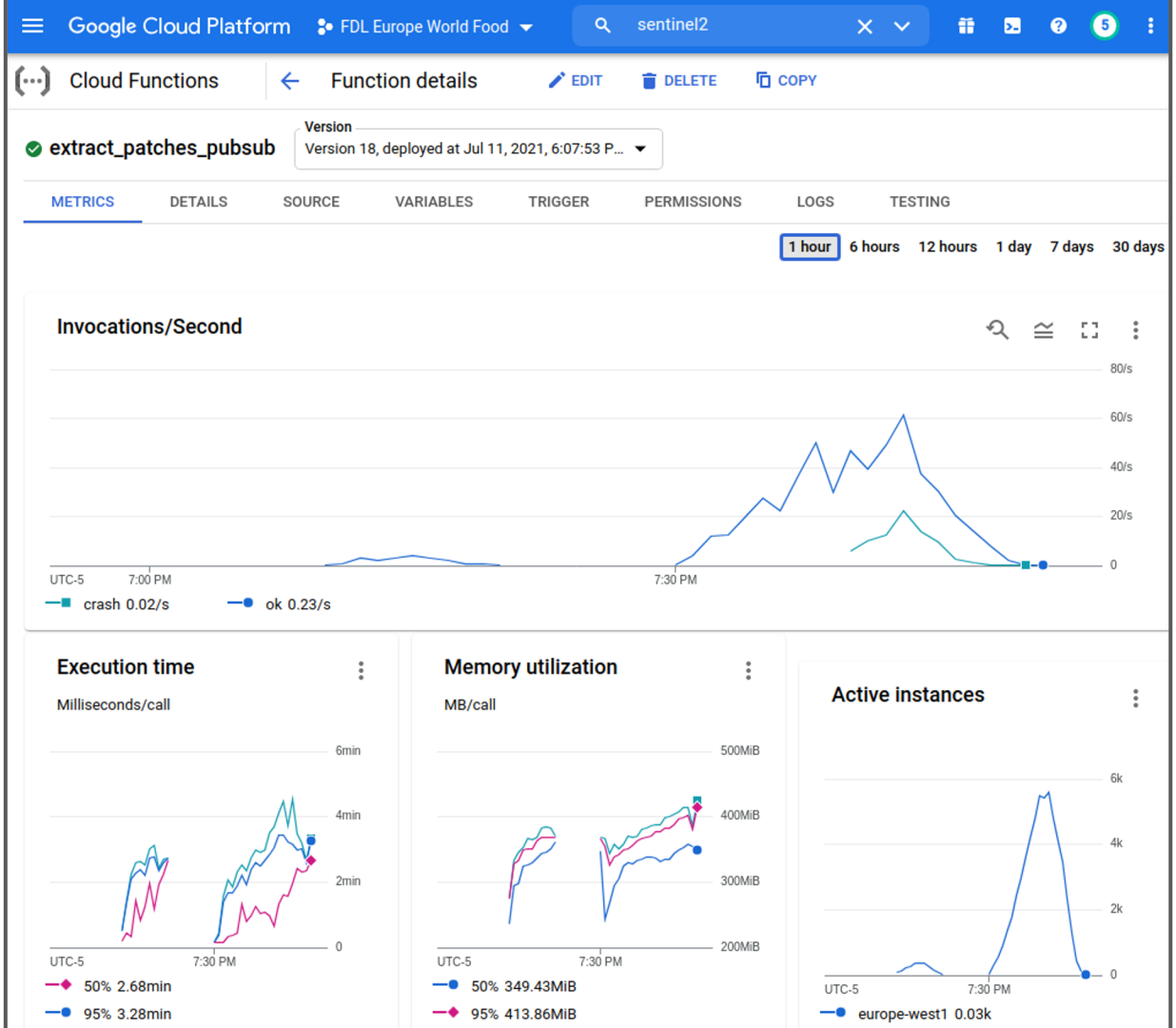
Sentinel-2 example chip (1km^2) with revisits and multiple bands





Multiband time series data is **large and complex**

1 km^2 11 bands 2.5 years time series → **5Gb** on disk **5D** [chip, time, band, W, H]


Google Cloud Platform
FDL Europe World Food
sentinel2
Cloud Functions
Function details
EDIT
DELETE
COPY
extract_patches_pubsub
Version
Version 18, deployed at Jul 11, 2021, 6:07:53 P...
METRICS
DETAILS
SOURCE
VARIABLES
TRIGGER
PERMISSIONS
LOGS
TESTING
1 hour
6 hours
12 hours
1 day
7 days
30 days
Invocations/Second
80/s
60/s
40/s
20/s
0
UTC-5
7:00 PM
7:30 PM
crash 0.02/s
ok 0.23/s
Execution time
Milliseconds/call
6min
4min
2min
0
UTC-5
7:30 PM
50% 2.68min
95% 3.28min
Memory utilization
MB/call
500MiB
400MiB
300MiB
200MiB
UTC-5
7:30 PM
50% 349.43MiB
95% 413.86MiB
Active instances
6k
4k
2k
0
UTC-5
7:30 PM
europe-west1 0.03k

FDL NASA/ESA Self Supervised learning for crop detection

SatExtractor

Extract everything from everywhere

SatExtractor

Build, deploy and extract satellite public constellations with one command line.

```
fran  master U:2 ?:46  c sat-extractor  ~/repos/sat-extractor  python src/satextractor/cli.py
2021-10-20 15:13:48.630 | INFO     | __main__:main:179 - Running tasks ['stac', 'tile', 'schedule']
2021-10-20 15:13:48.630 | INFO     | __main__:stac:33 - using satextractor.stac.gcp_region_to_item_collection stac creator.
2021-10-20 15:14:01.917 | INFO     | __main__:tiler:57 - using satextractor.tiler.split_region_in_utm_tiles tiler
2021-10-20 15:14:01.919 | INFO     | __main__:tiler:63 - loading vector file ./outputs/cordoba/cordoba.geojson and reducing geometries
2021-10-20 15:14:01.956 | INFO     | __main__:tiler:67 - {'_target_': 'satextractor.tiler.split_region_in_utm_tiles', 'bbox_size': 10000}
2021-10-20 15:14:02.275 | INFO     | __main__:tiler:71 - Generated tile patches: 240
2021-10-20 15:14:02.277 | INFO     | __main__:scheduler:79 - using satextractor.scheduler.get_scheduler scheduler
2021-10-20 15:14:02.278 | INFO     | __main__:scheduler:87 - Loading tiles and generating tasks
2021-10-20 15:14:02.295 | INFO     | satextractor.scheduler.scheduler:create_tasks_by_splits:58 - Loading items geojson...
2021-10-20 15:14:02.474 | INFO     | satextractor.scheduler.scheduler:cluster_tiles_in_utm:153 - Creating multipolygon of the tiles geomet
ries...
2021-10-20 15:14:02.583 | INFO     | satextractor.scheduler.scheduler:create_tasks_by_splits:65 - Creating extraction tasks for each const
ellations, date, and band ...
2021-10-20 15:14:02.584 | INFO     | satextractor.scheduler.scheduler:create_tasks_by_splits:92 - Getting cluster item indexes for sentine
l-2 in parallel...
Extraction Tasks creation.: 100%|                                                                | 27/27 [00:01<00:00, 15.90it/s]
```

▶ Table of Contents

About The Project

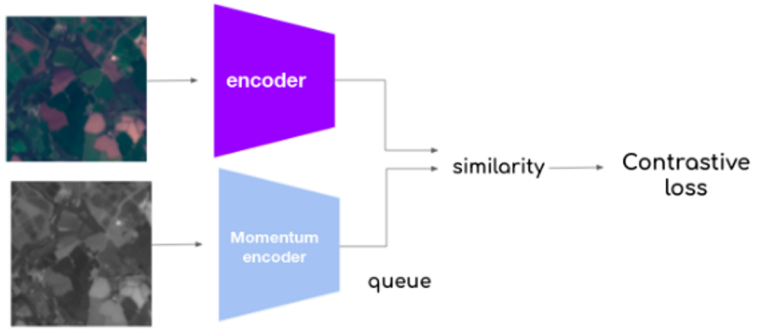
- *tldr*: **SatExtractor** gets **all revisits in a date range** from a given **geojson region** from any public satellite constellation and store it in a **cloud friendly format**.

https://github.com/FrontierDevelopmentLab/sat-extractor

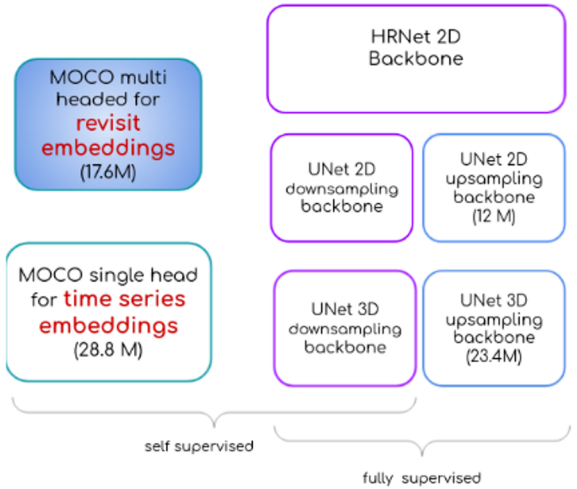
FDL NASA/ESA Self Supervised learning for crop detection

OUTCOME

Momentum contrast

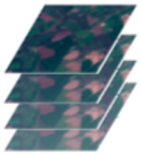


Architectures

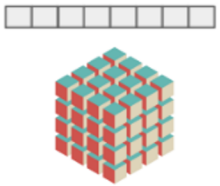


Embeddings produced

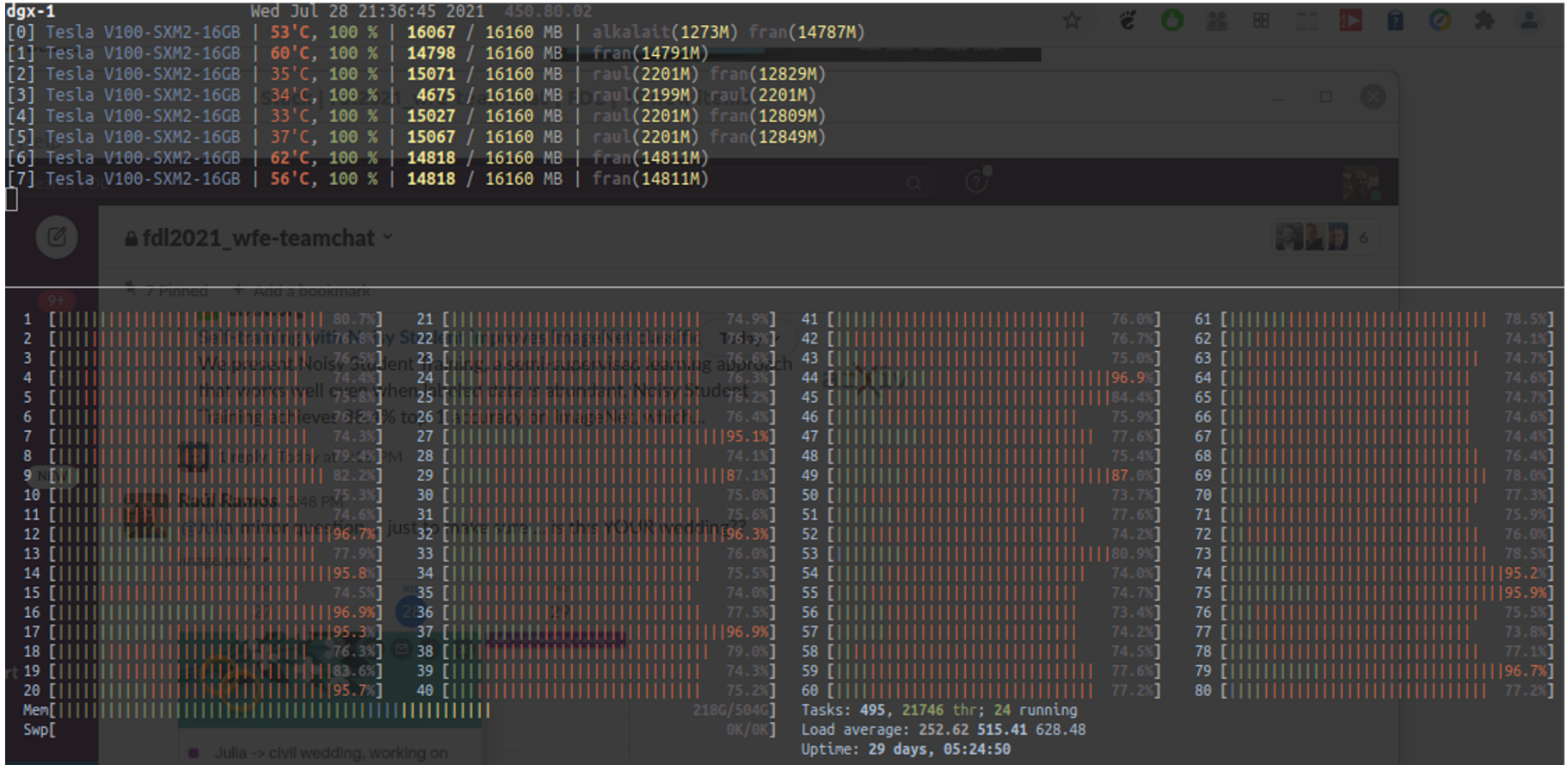
Per single revisit



Per full timeseries



NASA/FDL Self Supervised learning for crop detection



FDL NASA/ESA Self Supervised learning for crop detection

Select AOI South England

Hello this is some text describing this AOI.

Download Geojson

Crop/No Crop

Crop Type

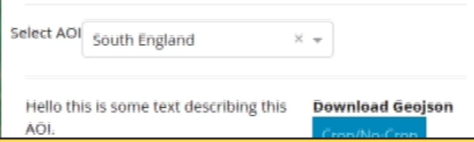
Draw a polygon to retrieve embeddings.

Spatial Similarity Search | Download Similar Geojson

FDL 2021 EARTH OBSERVATION

FDL AD ASTRA PER ALGORITHMOS 2021

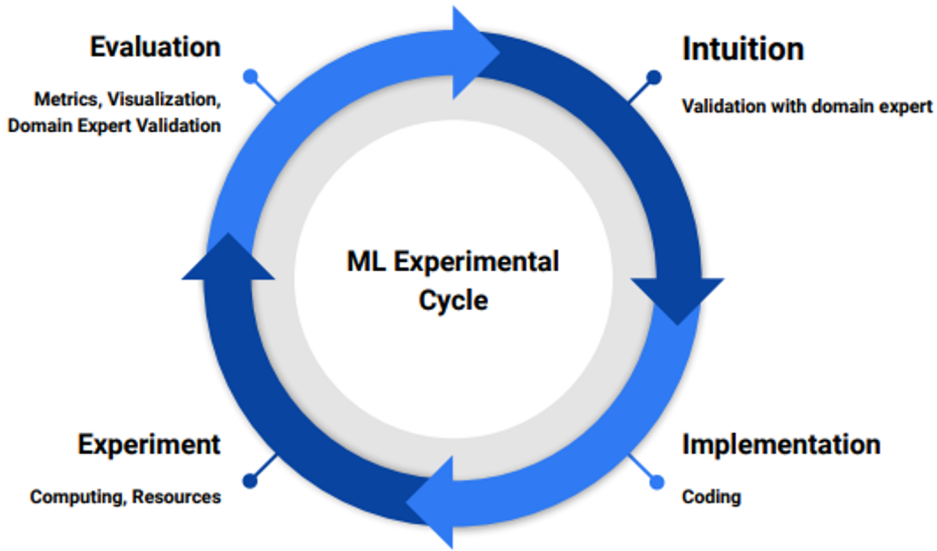
FDL NASA/ESA Self Supervised learning for crop detection



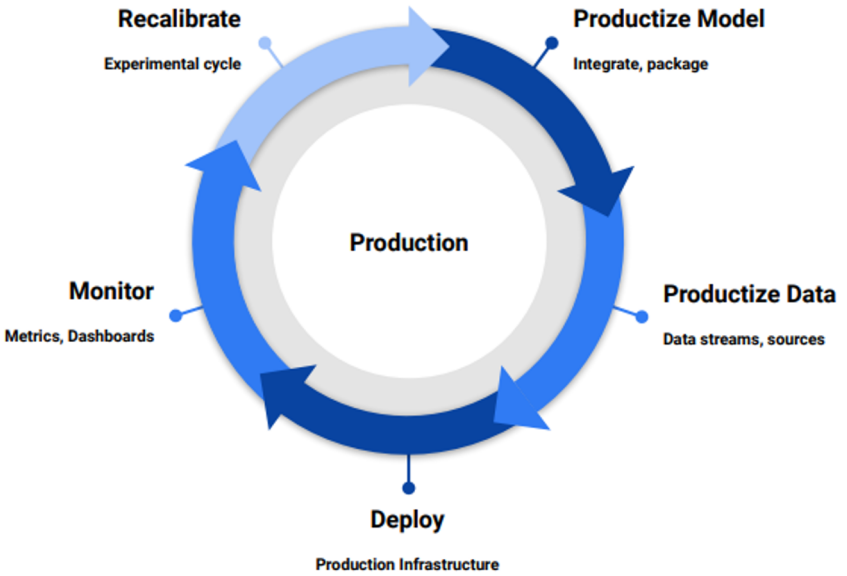
KEY CHALLENGES WERE NOT KNOWN AT THE BEGINNING

integración soluciones IA en la organización

experimental cycle

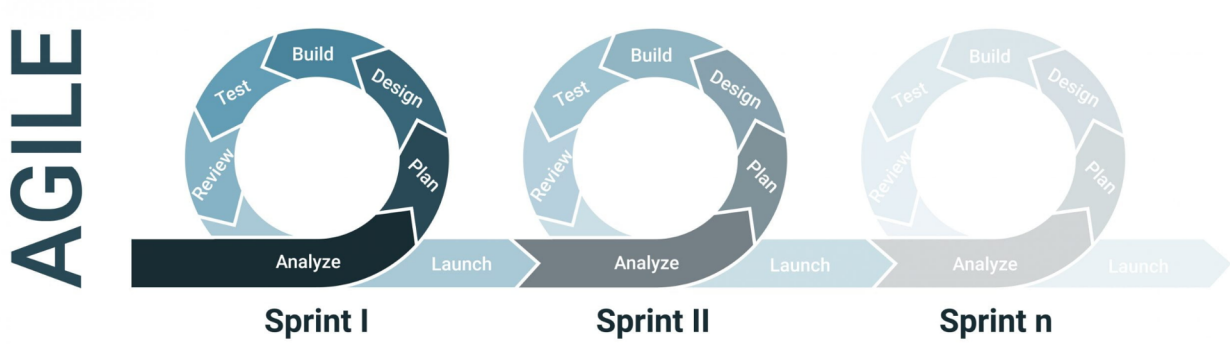


production cycle

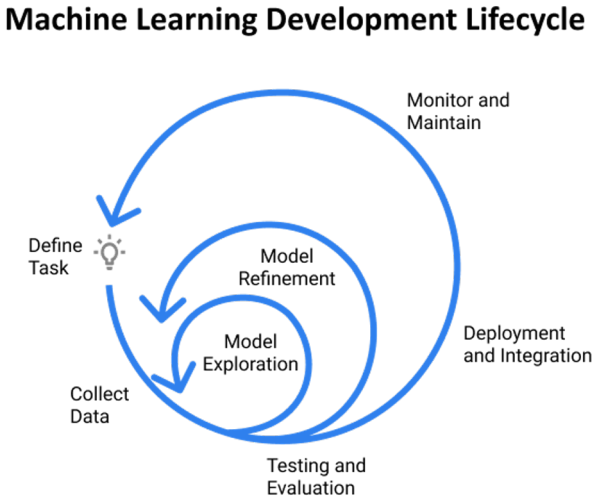


raul ramos - udea/landing.ai - raul.ramos@udea.edu.co

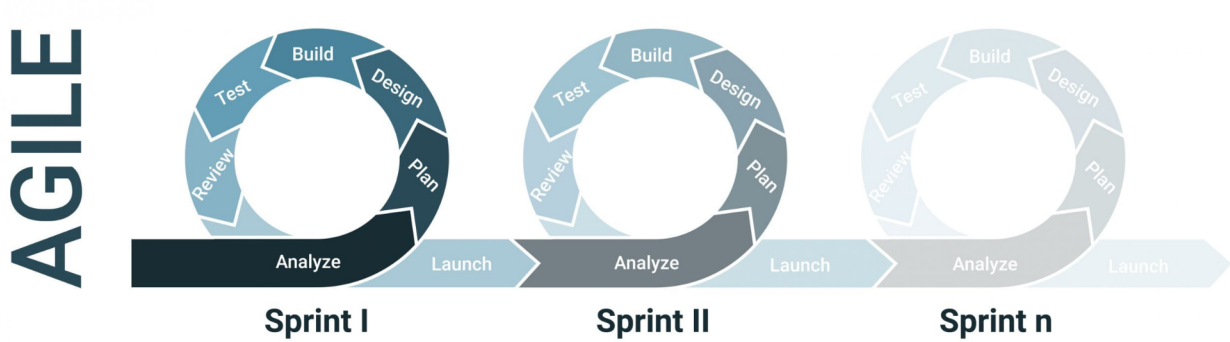
sw eng


AGILE
Build
Design
Plan
Launch
Analyze
Test
Review
Sprint I
Sprint II
Sprint n

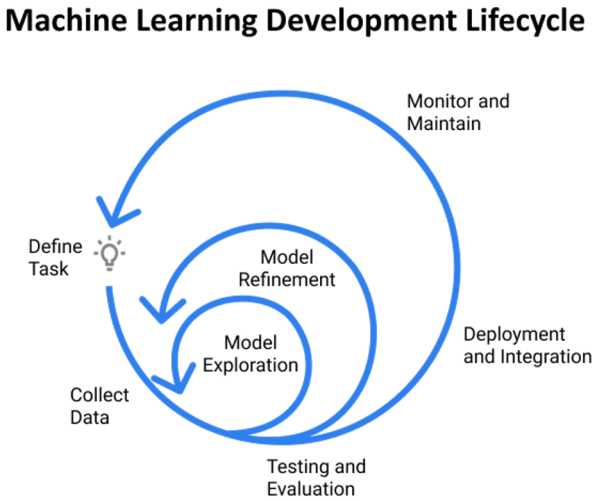
AI/ML


Machine Learning Development Lifecycle
Monitor and Maintain
Define Task
Model Refinement
Model Exploration
Deployment and Integration
Collect Data
Testing and Evaluation

sw eng



AI/ML



ai companies understand this kind of experimentation

ai customers still not so much!!!

Example FDL NASA/ESA research sprint

Week -2 Countdown	Week -1 Countdown	Week 0 Bootcamp
faculty and partner briefing	researcher briefing	establish strong structure, routines, procedures

Week 1 Exploration	Week 2 Development	Week 3 Development (**MAX Q**)	Week 4 Calibration	Week 5 Improvement	Week 6 Improvement	Week 7 Write up	Week 8 Showcase
domain and ML leads and researchers discuss opportunities and begin exploring the data **tools onboarding**	test and evaluate directions with initial prototypes	close down to a core concept, scope why it would be a breakthrough	review feedback and make assessments to steer progress	refine ML models and pipelines	produce working demo of the model or concept	polish deliverables, presentation and technical paper	prepare and deliver a TED-like style presentation and demo of the work

■ formal review (with external stakeholders)

Weeks 9 - 12
finalize tech memos, ensure reproducibility, finalize models and docs

Example FDL NASA/ESA research sprint formal review 1

The Big Why?

The underlying rationale or aim of this exercise is to enable you to get to know one another as a unit while working on an **applied project** and exploring the topic more together to:

- Explore best practice/state of the art research in the challenge area
- Understand the key areas within the topic
- Establish working practices
- Use the FDL tools

Your Mission...

Common pitfalls - misconceptions

- The customer has a precise idea of his needs
- Compete with experts vs. work with experts
- AI is a magical black box
- **Focus on technology not on problems**

- Sample data is representative for production data
- Deployment is trivial
- Metrics are known
- Lots of data is all we need
- Everyone will happily embrace AI
- We will be replaced by algorithms

THIS IS FUZZY BUSINESS → SOFT SKILLS

Hints for innovation

mutually mystified academy and industry (shrinking)

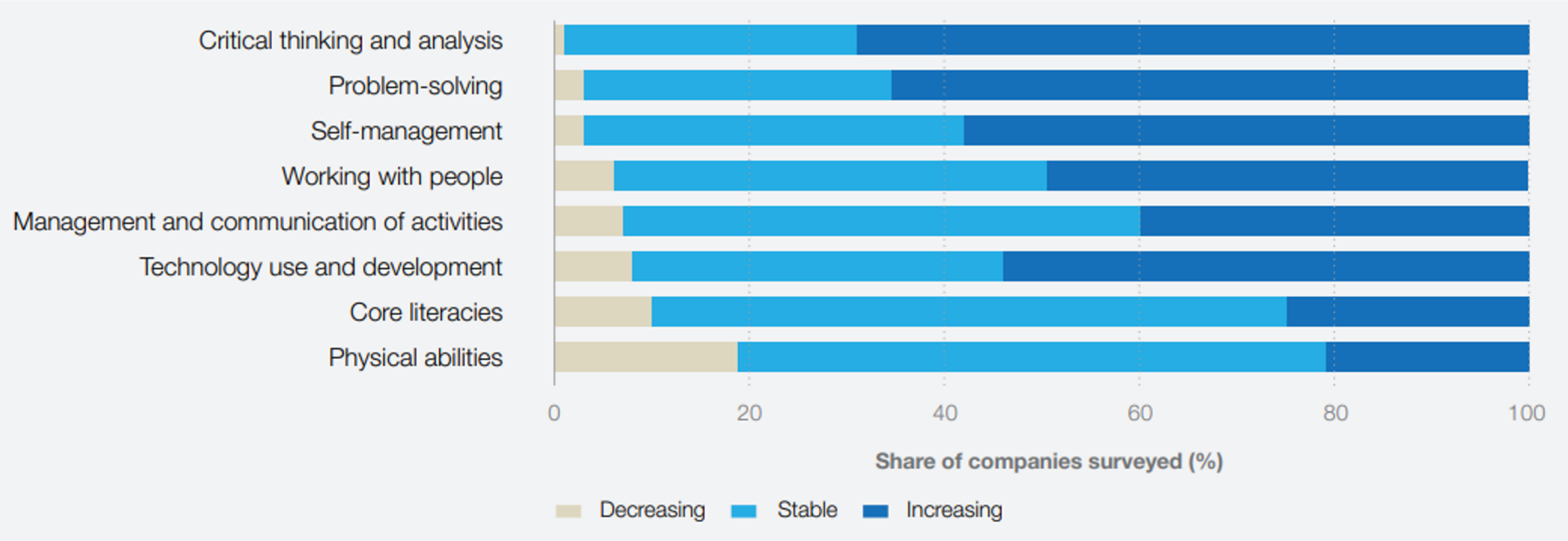
For individual careers

- Learn the fundamentals → be good technically
- Show yourself → kaggle, github
- Learn to solve not well defined problems
- Have initiative, take on any task, be modest, be bold
- Understand the big picture
- Become **TALENTED** in some specialty → FOCUS

perfection vs. practicality

World Economic Forum - The Future of Jobs

http://www3.weforum.org/docs/WEF_Future_of_Jobs_2020.pdf



Hints for innovation

For organizations

- Get/train **TALENTED problem-solving** people
- Create an **ecosystem** of problems, people, resources, computing
  - Think long term → learn to refine your opportunities!!
- Search **alliances** (specially for startups) - tech + domain knowledge
- Encourage **agility**, encourage **rigour**, do not lose sight
- Seek **external** multidisciplinary interventions / reviews
- Establish **motivational and collaborative** mechanisms

TOP TECHNOLOGY without a "WHAT FOR" is USELESS!!!!

raul.ramos@udea.edu.co

THnx

rramosp.github.io/ai4eng.v1

rramosp.github.io/2021.deeplearning

extra

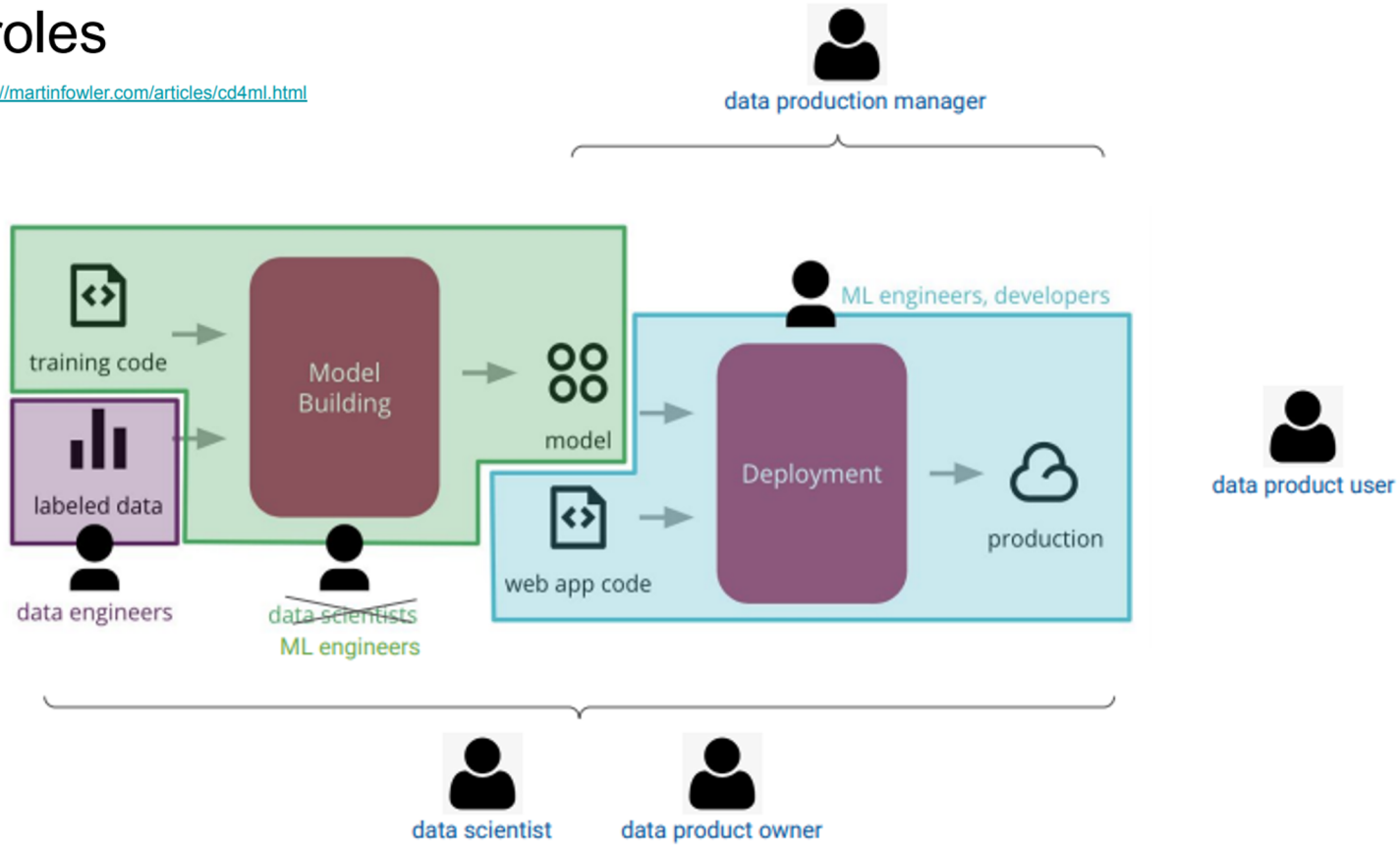
Lessons learnt

- Define metrics WITH customer !!!
- **Quick first end-2-end workflow**, then iterate
  - choose easy things first
  - iterate WITH customer
- **Learn customer domain**, vocabulary, culture
- Don't pre-judge, support/discard ideas ONLY with **data driven evidence**
- Identify level of maturity of customer (**what do they think of IA**)
- Identify who is who, internal teams
- **Manage expectations** → build gradually metrics, target tasks
- Don't forget BUSINESS metrics

integración soluciones IA en la organización

Team roles

adapted from: https://martinfowler.com/articles/cd4ml.html



integración soluciones IA en la organización