

Module 5 - Systems Thinking

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General Notes

- [Loopy](#).

Basics of Systems Maps

Elements are multiple factors affecting an issue.

- In a systems map, all elements are connected by relationships represented by the arrowhead lines.
- Loops indicate the direction and degree of feedback.
- Outcome changes when the elements or relationships are changed.

There are two types of relationships:

- **Positive** represented by a +
 - An increase in the input leads to an increase in the output
- **Negative** represented by a -
 - An increase in the input leads to a decrease in the output

Principles of Systems Thinking

Interconnectedness

Interconnectedness: Shifting a mindset from linear to circular.

- Seeing the connections between things rather than the immediate result.

Example of Circular Mindset

Your algorithm is not producing the results you were expecting.

- **Linear:** You try to change the test case to get the results you want
- **Circular:** You try to see if there is issues with your algorithm architecture or data inputted to see if that is why you are getting error in results

Synthesis

Synthesis: Dissection of complexity into manageable components.

Emergence

Emergence: The outcome of the synergies of the parts.

- After splitting the problem into parts and decide on the best solution, you evaluate what emerges from your solution and understand why it came to be.

Feedback Loops

Feedback Loops: How your elements increase or decrease to either create more / less of itself or to balance between other elements.

- **Reinforcing Feedback:** Reinforce more of the same element in a system.
 - *Ex. Population Growth*
- **Balancing Feedback:** Balance between the elements in a system is to not have over abundance of one.
 - *Ex. Predator / Prey*

Causality

Causality: How one change results in an overall change of the state of the dynamic and evolving system.

- Cause and effect
 - AI systems now use statistical models rather than strictly cause and effect.
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Further Reading

- Thinking in Systems by Donella Meadows: <https://wtf.tw/ref/meadows.pdf>
- Loopy, a tool for thinking in systems: <https://ncase.me/loopy/>
- Sustainable Development Goals: <https://www.undp.org/content/undp/en/home/sustainable-development-goals.html>

AI Industry Guest Speaker

[Next Lesson](#)

General Notes

- **Single Board Computers (SBC)** are things like raspberry pi's.
- Intel's Myriad X is a vision accelerator designed to be used with AI.
 - Intel Movidius VPU
- <https://deeplearn.org>

- <https://pyimagesearch.com>

Industrial AI

Consists of:

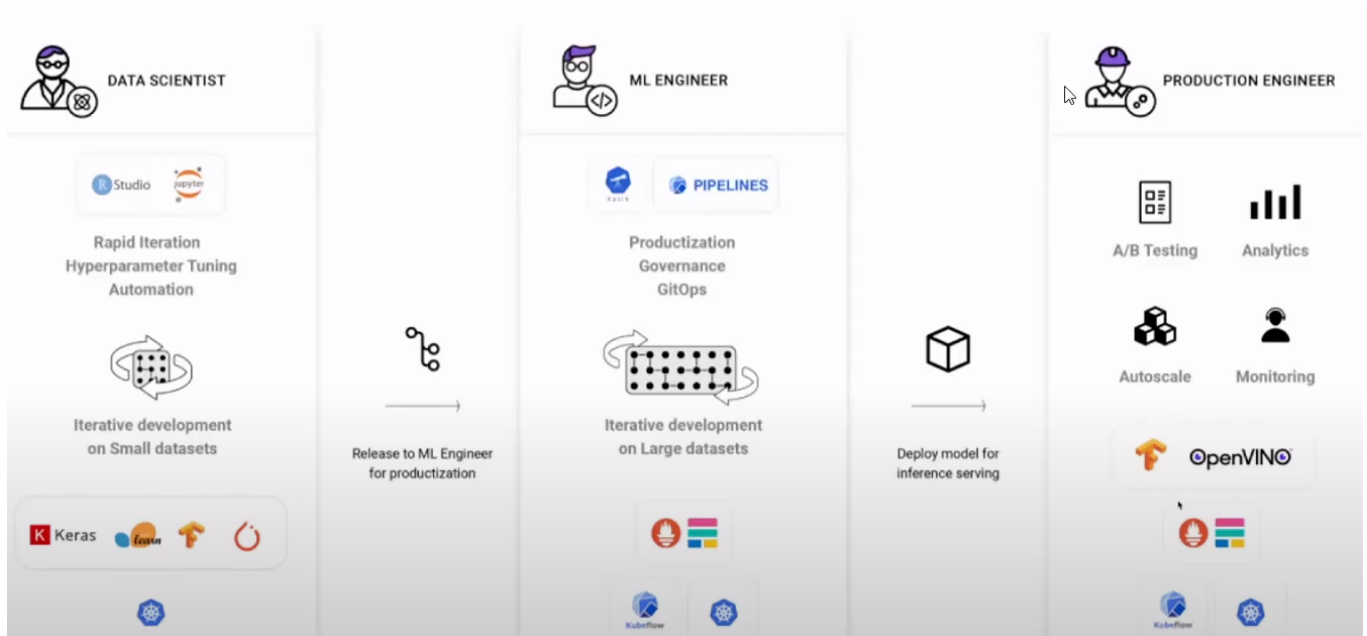
- Anomaly Detection
- Quality Control
- Predictive Maintenance
- Process Monitoring

In a typical factory setting, there are 2 - 3 different algorithms (OpenCV, Deep Learning, etc.) running on a given defect type.

Key Challenges in Industrial AI:

- **Labeled datasets**
- **Small sample size of defects**
 - One thing that people do is synthetically create defects

Types of Machine Learning Jobs



- Data scientist
 - Comes up with the latest and greatest neural network architectures and computational algorithms
- ML Engineer

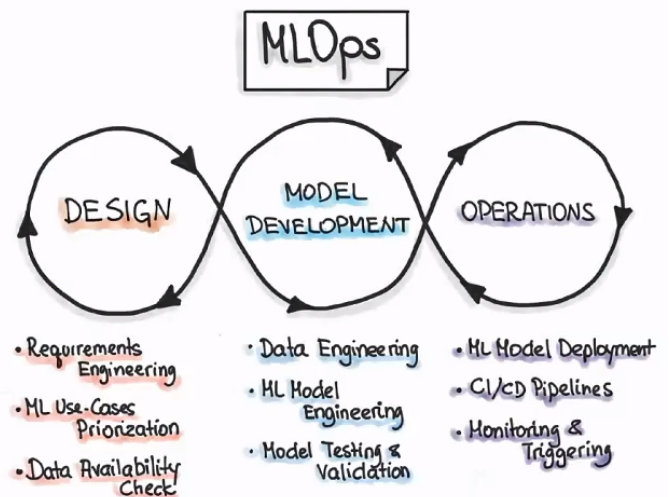
- Productize the model that was created: Web API's, security, model decay, etc.
- Production Engineer
 - The person who is normally on the floor who is the factory operator.

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- If a proprietary algorithm is licensed, you can do things like royalties and revenue share models.
 - Most of the coding is in the ML Engineer category

MLOps Engineer

Tools

- Jenkins
- Kubernetes
- Docker
- Git
- Ansible/Chef
- AWS/Azure/Google Cloud



- **DevOps** is the way of combining the code, build, deploy, testing, and different buckets into one pipeline.
 - DevOps focuses on automating all of that.
- **MLOps** is an extension of DevOps. They're similar, but there are some key differences.
 - More oriented around governance for models and AI
- Jenkins is the CI/CD Pipeline
- Kubernetes and Docker handle containerization
- Git is for versioning
- Ansible/Chef automate bringing up the systems
- AWS/Azure/Google Cloud are CSVs (Cloud Service Providers) for deployment.

Data Engineer

Role

- Process large amounts of data at a scale
- Improve data reliability and quality
- Data acquisition methods

Tools

- MongoDB, PostgreSQL
- Spark
- Hadoop

Lab - Audio Classifier

Sources

- <https://teachablemachine.withgoogle.com/train/audio>
- <https://medium.com/@warronbebster/teachable-machine-tutorial-snap-clap-whistle-4212fd7f3555>
- [Teachable Machine](#)

Creating The Sample Data

[Youtube Tutorial](#)

- The overlap factor should be lower if you're having trouble seeing what it classifies it as.

Understanding The Model

Read [this article](#)