

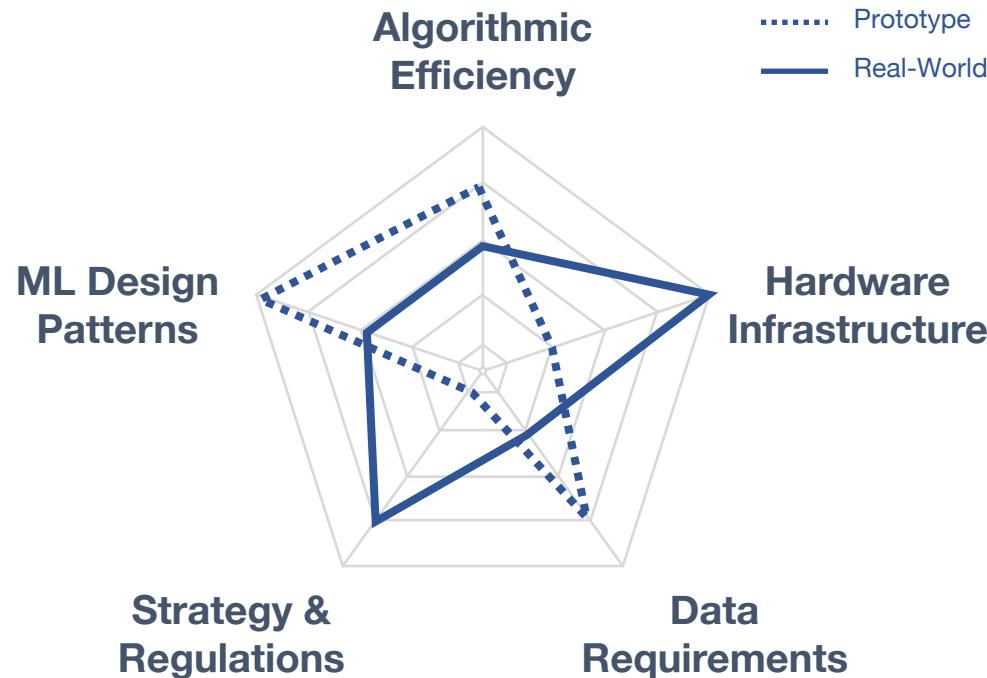
ML-Ops

Philosophy, Best-Practices and Tools

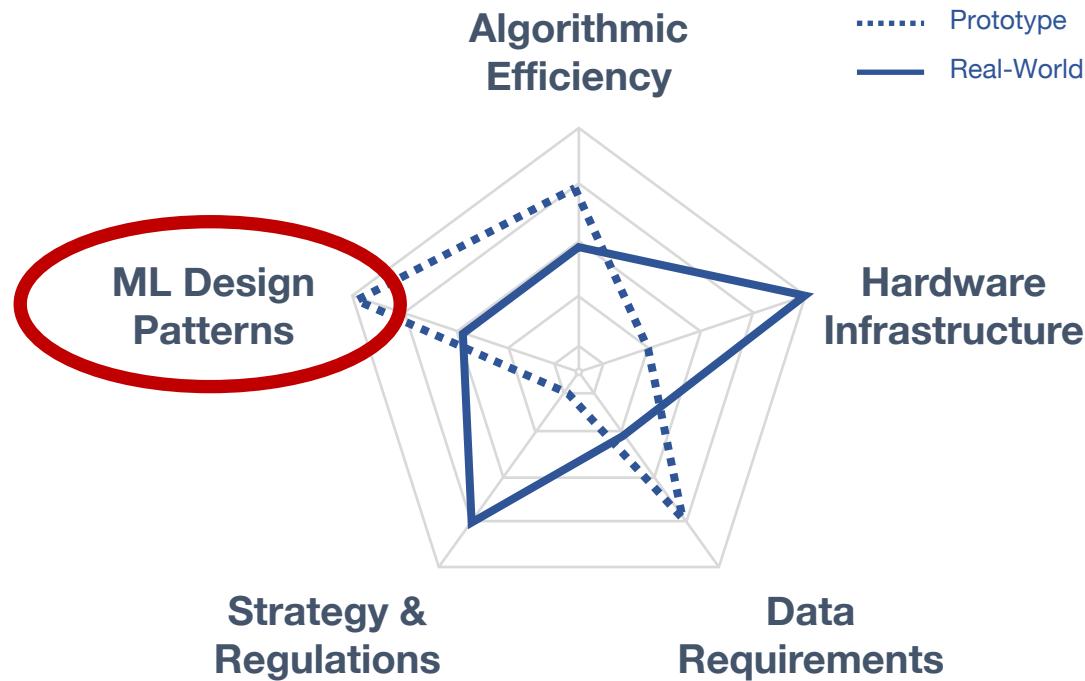
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5 Dimensions of ML Projects



5 Dimensions of ML Projects



Philosophy

Philosophy

“DevOps is an organizational and cultural movement that aims to increase software delivery **velocity**, improve service **reliability**, and build **shared ownership** among software stakeholders.”

- Google [1]

“At its simplest, DevOps is about **removing the barriers** between two traditionally siloed teams, development and operations.”

- AWS [2]

[1] <https://cloud.google.com/devops>

[2] <https://aws.amazon.com/devops/what-is-devops/>

Philosophy

“the extension of the DevOps methodology to include Machine Learning and Data Science assets as first class citizens within the DevOps ecology”

- Continuous Delivery Foundation’s SIG-MLOps ^[1]

“a software engineering approach in which a cross-functional team produces machine learning applications based on code, data, and models in small and safe increments that can be reproduced and reliably released at any time, in short adaptation cycles.”

- Martin Fowler ^[2]

[1] <https://github.com/cdfoundation/sig-mlops>

[2] <https://martinfowler.com/articles/cd4ml.html>

Best Practices

What's sticking?

- Continuous Integration
- Continuous Delivery
- Microservices
- Infrastructure as Code
- Communication and Collaboration

What's new?

From:

- Code versioning

To:

- Code versioning
- **Model** versioning
- **Data** versioning

Tools

Platforms

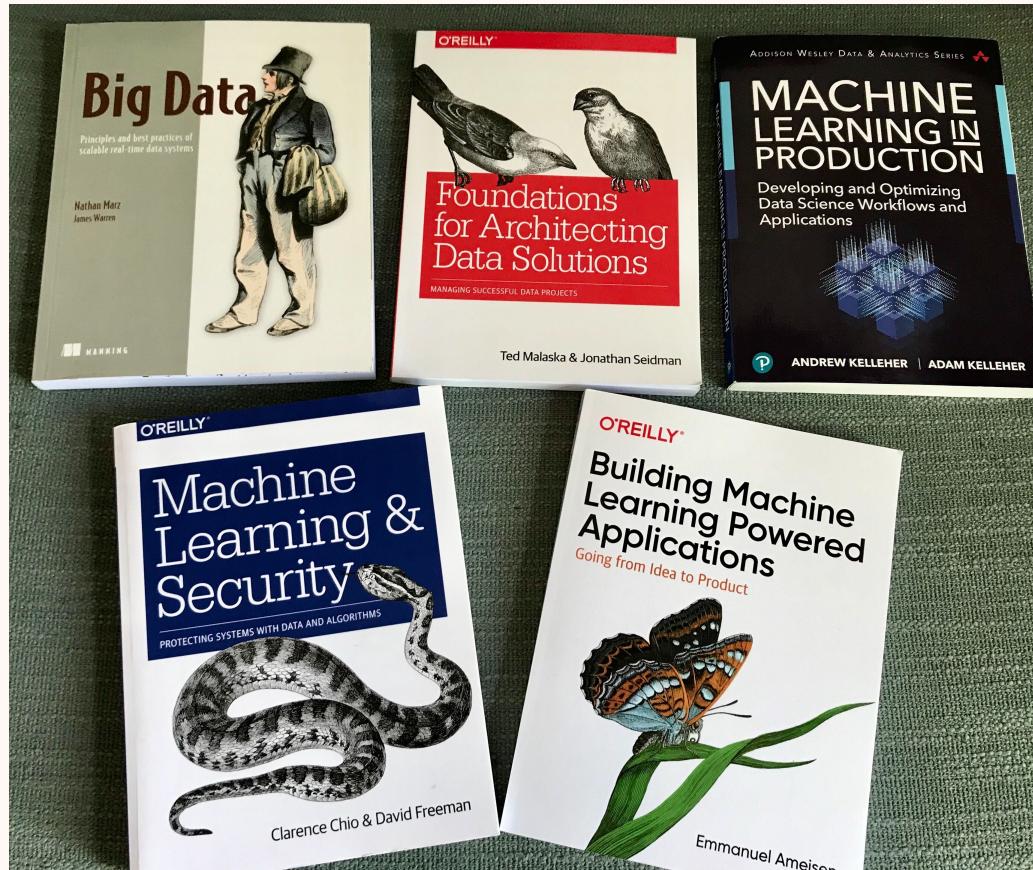
Data/Model versioning:

- <https://dvc.org>
- <https://github.com/pachyderm/pachyderm>
- <https://delta.io>
- <https://hudi.apache.org>
- <https://datahub.io>

Workflows/Experiment tracking:

- <https://www.floydhub.com>
- <https://www.wandb.com>
- <https://www.paperspace.com>
- <https://www.tensorflow.org/tfx>
- <https://aws.amazon.com/sagemaker>

Literature



Literature

MLOps with a Feature Store

<https://www.logicalclocks.com/blog/mlops-with-a-feature-store>

Hidden Technical Debt in Machine Learning Systems

<https://papers.nips.cc/paper/5656-hidden-technical-debt-in-machine-learning-systems.pdf>

Studying Software Engineering Patterns for Designing Machine Learning Systems

<https://arxiv.org/pdf/1910.04736.pdf>

Machine Learning Architecture and Design Patterns

http://www.washi.cs.waseda.ac.jp/wp-content/uploads/2019/12/IEEE_Software_19_ML_Patterns.pdf

Patterns (and Anti-Patterns) for Developing Machine Learning Systems

https://www.usenix.org/legacy/events/sysml08/tech/rios_talk.pdf

Patterns for machine learning-powered features

<https://material.io/collections/machine-learning/patterns-for-machine-learning-powered-features.html>

Take away

Wrap Up

What are MLOps?

Principles for automating the:

- Building
- Testing
- Deployment
- Maintenance

of ML systems.

Why are MLOps crucial?

Is a proven approach to improve:

- Speed
- Delivery
- Reliability
- Scaling
- Collaboration
- Security

in ML developments.

Let's connect in LinkedIn!



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Focus
AI | Reinforcement Learning
Data Science
Robotics

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