FEATURE STORE SUMMIT

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ORGANIZED BY HOPSWORKS

FIXING MODELS BY FIXING DATASETS

// BEING DATA-CENTRIC IS THE FUTURE OF AI

Atindriyo Sanyal
Co-Founder
Galileo Technologies

FIXING MODELS BY FIXING DATASETS

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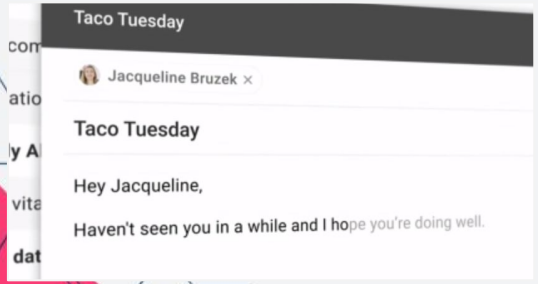
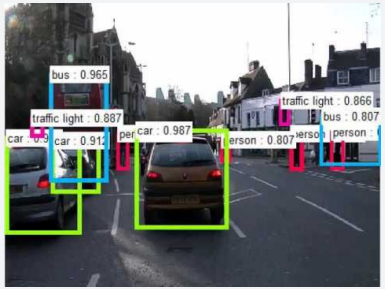
Feature Stores for ML

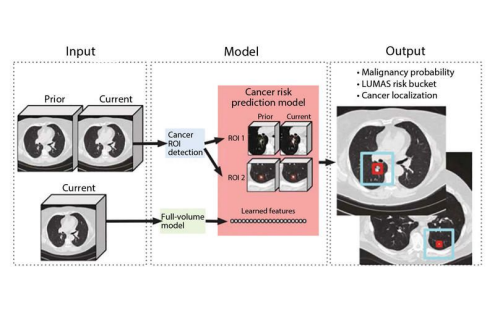
INTRODUCTION

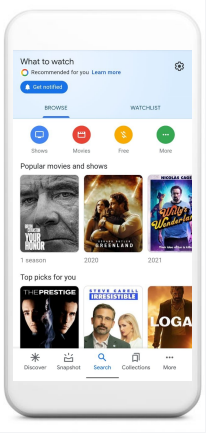
- ML is everywhere
  - Software applications → 2010s
  - ML applications → 2020s

- Early Innings and critical for high stakes decisions









Feature Stores for ML

MODEL ARCHITECTURES ARE COMMODITIZED

- Models are increasingly commoditized 🤗 Transformers IMAGENET
- Hyperparameter tuning is standardized
- ML Infrastructure maturing
  - Feature Stores / Embedding Stores
  - Scalable Deep Learning Frameworks

EXPLOSION OF ML MODELS

BAD DATA QUALITY

WELL TRAINED MODEL

POOR PREDICTIONS

REDUCED CHURN
HIGHER NPS
INCREASED LTV
HIGHER REVENUE
... AND MORE

ENSURING **CONTINUOUS HIGH QUALITY DATA** POWERS **HIGH QUALITY PREDICTIONS**

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THE ISSUE LIES IN THE DATA

- Features are hard to find
- When found, often noise laden, insufficiently well-labelled and low quality
- Kitchen sink of data thrown at the model
  - Models trained on noisy data
  - Lack of real time observability leading to training-serving skew

Feature Stores for ML

DATA QUALITY ISSUES ACROSS THE WORKFLOW

Feature Discovery

Feature Preparation

Model Training

Model Evaluation

Model Inference

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DATA QUALITY ISSUES ACROSS THE WORKFLOW

Feature Discovery

Feature Preparation

Model Training

Model Evaluation

Model Inference

Finding the ideal dataset.

→ Curate & Find the most representative data

→ Get maximum lift with minimum data

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DATA QUALITY ISSUES ACROSS THE WORKFLOW

Feature Discovery

Feature Preparation

Model Training

Model Evaluation

Model Inference

Trusting your dataset.

→ Identify regions of Model Underperformance
→ Model robustness across sub-populations
→ Identify similar and dissimilar examples
→ Identify and fix noisy data and labels

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DATA QUALITY ISSUES ACROSS THE WORKFLOW

Feature Discovery

Feature Preparation

Model Training

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Model Inference

Evaluating your Test Data

→ Identify regions of Model Underperformance
→ Model robustness across sub-populations
→ Detecting clusters of noise

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DATA QUALITY ISSUES ACROSS THE WORKFLOW

Feature Discovery

Feature Preparation

Model Training

Model Evaluation

Model Inference

Close the training<>serving loop.

→ Training<>Serving skew detection

→ Drift Detection

→ Real time data quality monitoring

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DATA QUALITY ISSUES ACROSS THE WORKFLOW

Feature Discovery	Feature Preparation	Training & Evaluation	Inference
Finding the right Features Curate the most representative data	Inspect & Curate your dataset Identify and fix 'noisy' examples Identify anomalies	Optimize ML developer time ML data error analysis Model robustness across regions	Adapting to the changing world Training-Serving skew detection Data Quality Monitoring

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CURATE THE MOST REPRESENTATIVE DATA

- Data Annotation budgeting via Active Learning
  - Identifying high value data via embeddings
    - K distributed cores
  - Identifying high value data via model uncertainty
    - sampling based on proximity to decision boundary
  - Clustering similar samples
  - Clustering dissimilar samples

- Optimal Feature Discovery
  - Filter by Feature Redundancy and Relevance to Labels
  - Entropy and Mutual Information

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IDENTIFYING NOISY DATA AND LABELS

- Model based **confidence-uncertainty** metric
  - Margin sampling to identify potentially mislabelled examples
  - Monitoring high-low confidence-certainty regions

- Model based **certainty** in datasets
  - Class conditional joint distributions
  - Estimating Confident Joints
  - Data-independent estimation of incorrect classes

FINDING DATASET VULNERABILITIES

- Detecting regions of model underperformance
  - Model based confidence-certainty
    - Detecting confusion
    - Detecting noise
    - Separating easy data from hard data
- Instrumenting sub-populations of underperformance
  - Programmatic Assertions on Datasets
  - Patterns / Clusters within underperforming regions
    - Leveraging embeddings
- Optimizing ML development time
  - Systematic ML Data Error Analysis
  - Test model robustness across subpopulations

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ADAPTING TO THE CHANGING WORLD

- Real-time detection of **Training<>Serving skew**
- **Monitoring subpopulations** of interest
- **Augmenting new data** for auto-retraining
  - Synthetic Data Generation
  - Alternative Knowledge Bases or Pre-trained models

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DATA QUALITY ACROSS THE WORKFLOW

- **Evaluating** Data Quality for Train & Test Datasets
- **Gating** Pipelines on Data Quality
- **Storing** high value feature sets from unlabelled data
- Model Evaluation using **historically similar Feature Sets**
- **A/B Testing** across training, evaluation and serving data

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Thank you!

Do you have any questions?

Atindriyo Sanyal
Co-Founder, Galileo

https://www.linkedin.com/in/atinsanyal/

https://twitter.com/atinsanyal