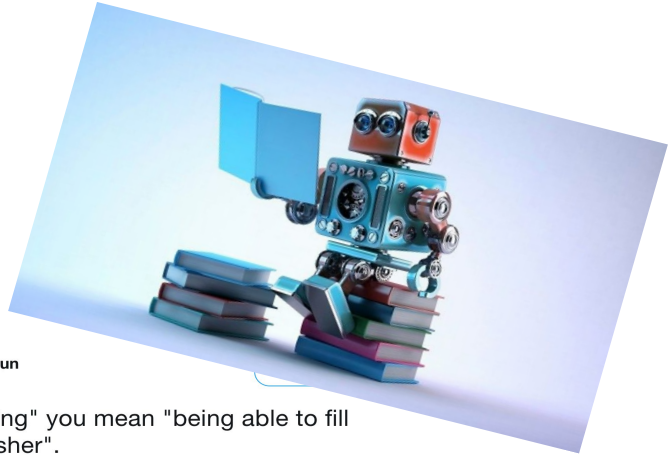
Machine Learning
A Short Intro

Engineering COP

Sertan Şentürk - Lead Data Scientist



Yann LeCun
@ylecun

If by "uprising" you mean "being able to fill the dishwasher".

technologyreview.com/s/611424/this- ...

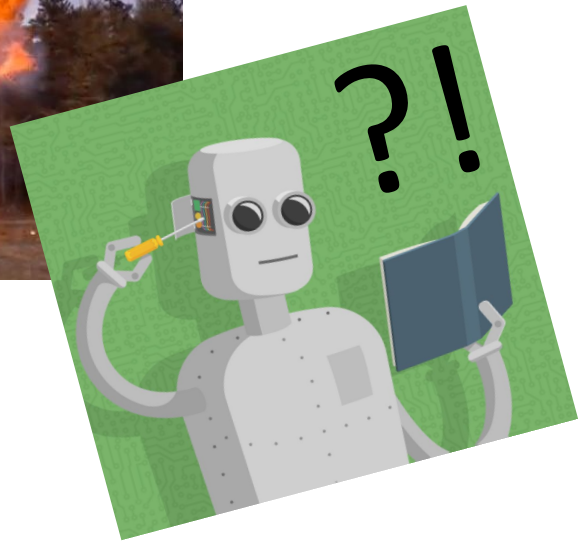
This is how the robot uprising finally begins

Combining the latest advances in artificial intelligence with robots could transfo
manufacturing and warehousing—and take AI to the next level.

technologyreview.com

THE

IS



What?

Case Study

Conceptual Process

Disclaimers

- Quite high level
- Almost no math!
- Interactive!
- Emphasis on music tech

What?

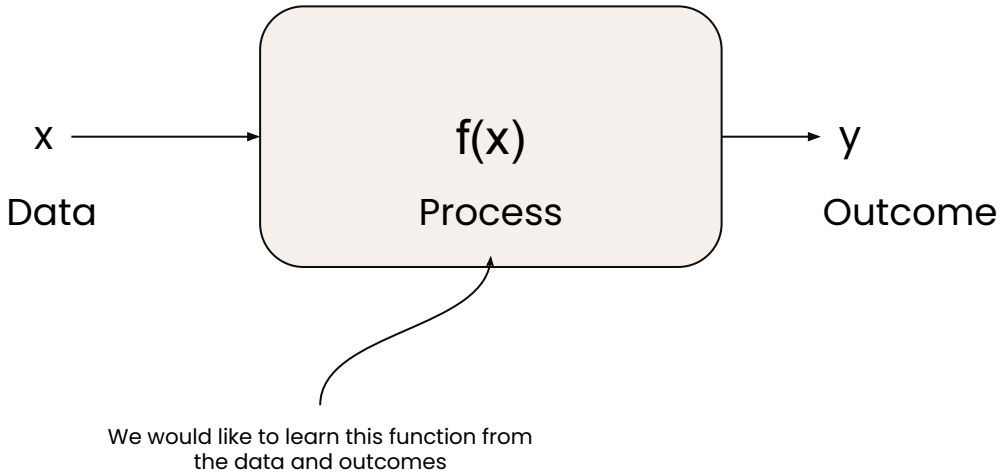
Machine Learning: A Definition

the field of study
that gives computers
*the ability to **learn***
without being explicitly programmed

Tom Mitchell, 1950s

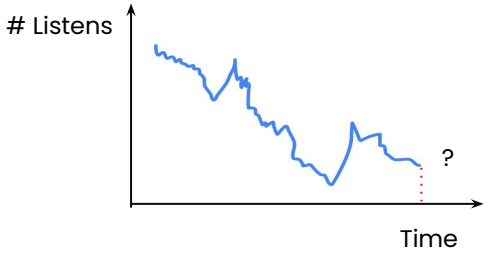
Kind of early, isn't it?

https://www.coursera.org/lecture/machine-learning/what-is-machine-learning-Ujm7v


x
Data
f(x)
Process
y
Outcome
We would like to learn this function from
the data and outcomes

Case Study

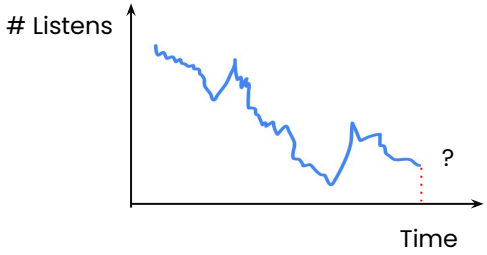
Pick a random number
Past streams -> something similar
Market Trend (wrt genre)
Listening habits in Spotify
Seasonal changes
Time during the day
Social Media
Usage in different media
Pandemic



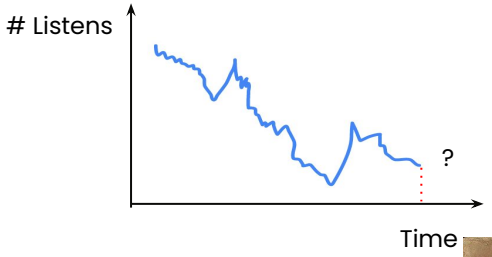
Song → Estimate # Weekly Listens In Spotify US → N

Listens Now
Listens from in the Past
…
Playlists the Song is In
Shares in Social Media
…
News about the Artist
Upcoming concerts
…

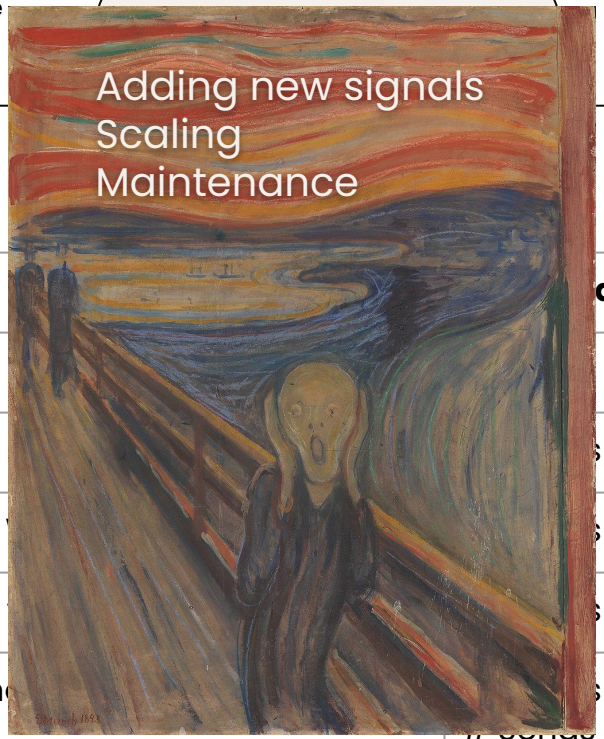
Pick this week's listens
Moving Average
Statistics



Solution	**# of Data Pt.**	**# Params to Fit**
Last Week's Listen	1	None
Average of Last Weeks	# Weeks	None
Fit a line (y = ax + b) to last Weeks; extrapolate	# Weeks	a, b
Fit more complex functions to last Weeks; extrapolate	# Weeks	constants of the f
Fit individual functions to many songs; weighted extrapolation	# Weeks * # Songs	consts. per song & weights



Song → N



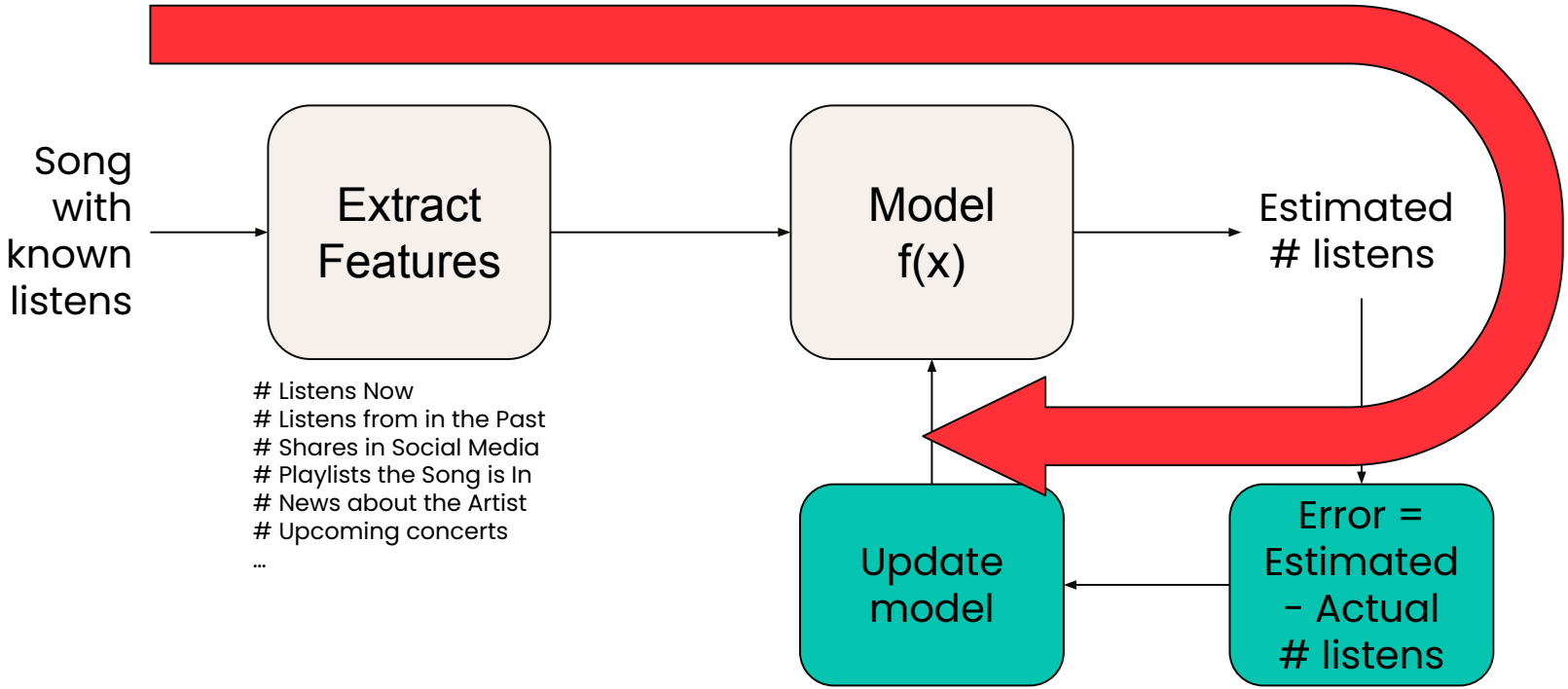
Solution	**a Pt.**	**# Params to Fit**
Last Week's Listen		None
Average of Last Weeks	s	None
Fit a line (y = ax + b) to last	s	a, b
Fit more complex functions	s	constants of the f
Fit individual functions to m extrapolation	s *	consts. per song & weights

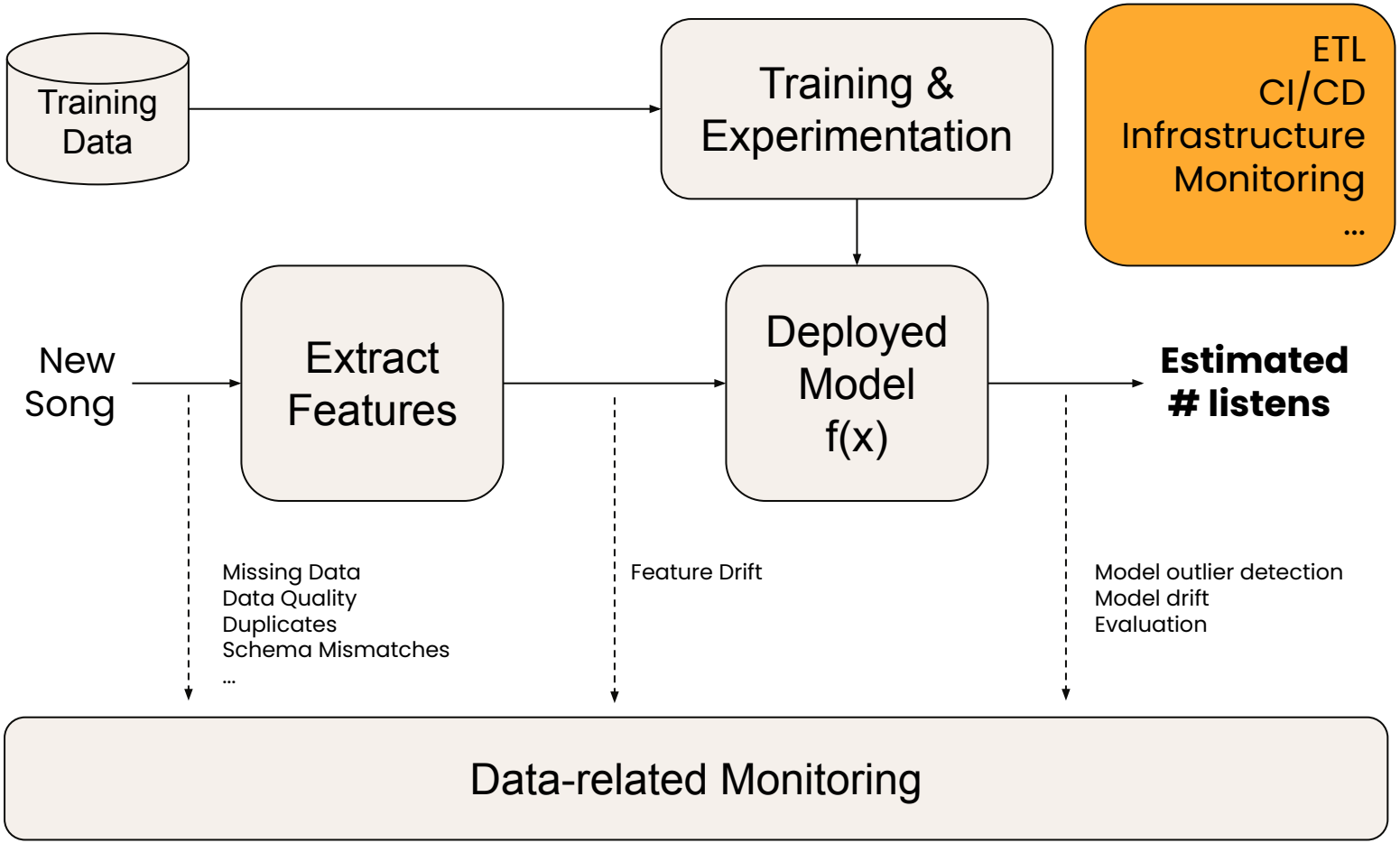
Which Problems are ML Good at Solving?

- Difficult to formulate
  - **Example:** Music recommendation (What would you like to listen today?)
- Many interactions affecting the outcome
  - **Example:** Estimating # listens of a song
- Has a lot of special cases to consider
  - Rigorous, repetitive tasks with limited time/resources
  - **Example:** Metadata Matching
- Processing unstructured data
  - audio, video, image, plain text
  - **Example:** Auto-Tagging audio recordings, Music similarity for Synch

How?

Do this for all <u>available songs</u>
for <u>multiple times</u>
Until the **Error is Minimized**




Training Data
Training & Experimentation
ETL
CI/CD
Infrastructure
Monitoring
...
New Song
Extract Features
Deployed Model f(x)
Estimated # listens
Missing Data
Data Quality
Duplicates
Schema Mismatches
...
Feature Drift
Model outlier detection
Model drift
Evaluation
Data-related Monitoring

Resources

Resources

- Fast.ai
- Coursera (Machine Learning, Deep Learning)
- Sebastian Raschka's Online Lectures
- Aurelien Geron - Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow

- PyData Meetups
- London Music and AI Meetup

- NYU Deep Learning Course
- Full Stack Deep Learning
- Valliappa Lakshmanan - Machine Learning Design Patterns

- Christopher Bishop - Pattern Recognition and ML
- Ian GoodFellow - Deep Learning