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Human Factors in AI
Course Overview
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Why Take This Course?

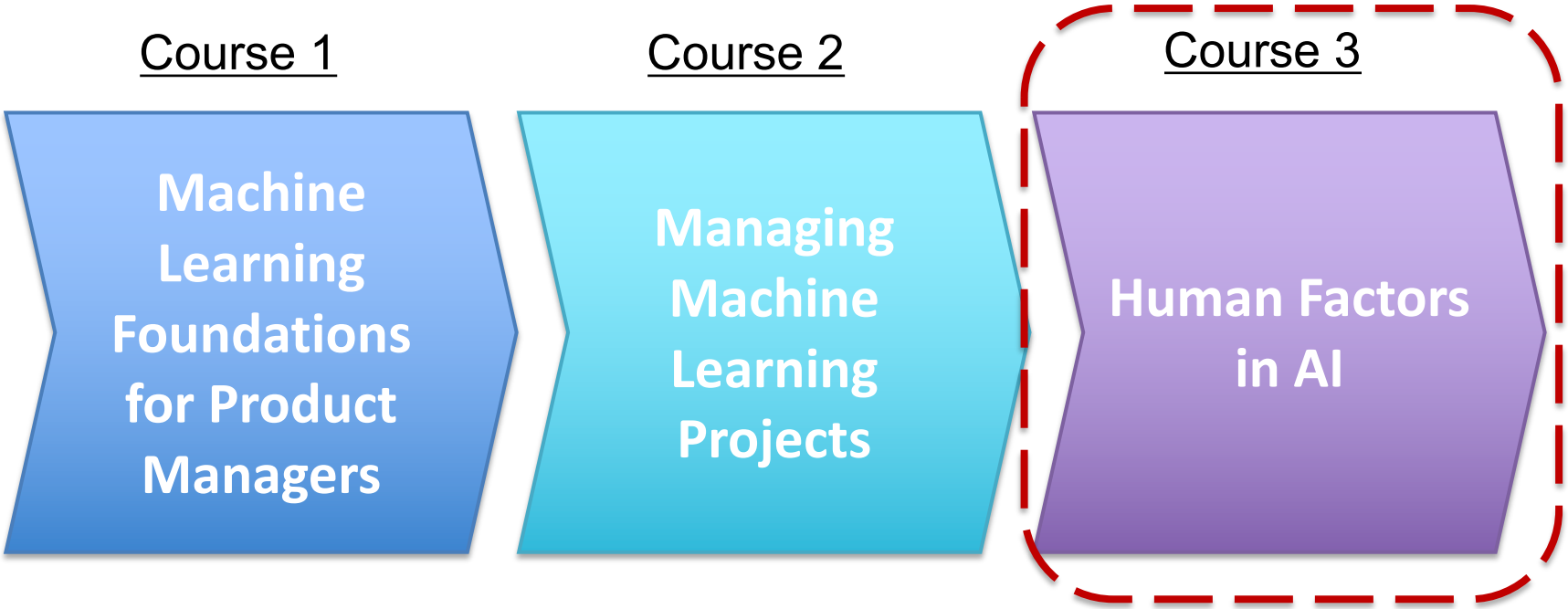
- Use of AI for automated decision-making can have major consequences on users
- AI systems are highly susceptible to:
  - Infringing privacy
  - Biased decision-making
  - Resistance to adoption
- Need to proactively mitigate these risks through human-centered design

Course Learning Objectives

At the conclusion of this course, you should be able to:

1) Identify and mitigate privacy and ethical risks in AI projects
2) Apply human-centered design practices to design successful AI product experiences
3) Build AI systems which augment human intelligence and inspire model trust in users

AI Product Management Specialization



Course Outline

Module	Topic
1	Design of AI Product Experiences
2	Data Privacy and AI
3	Ethics in AI
4	Human & Societal Considerations

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Module 1: Design of AI Product Experiences

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Module 1 Objectives:

At the conclusion of this module, you should be able to:

1) Apply design thinking principles to design human-centered AI product experiences
2) Explain the key user experience design decisions unique to AI products
3) Integrate model transparency, communication of uncertainty and feedback loops within products

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Design Thinking

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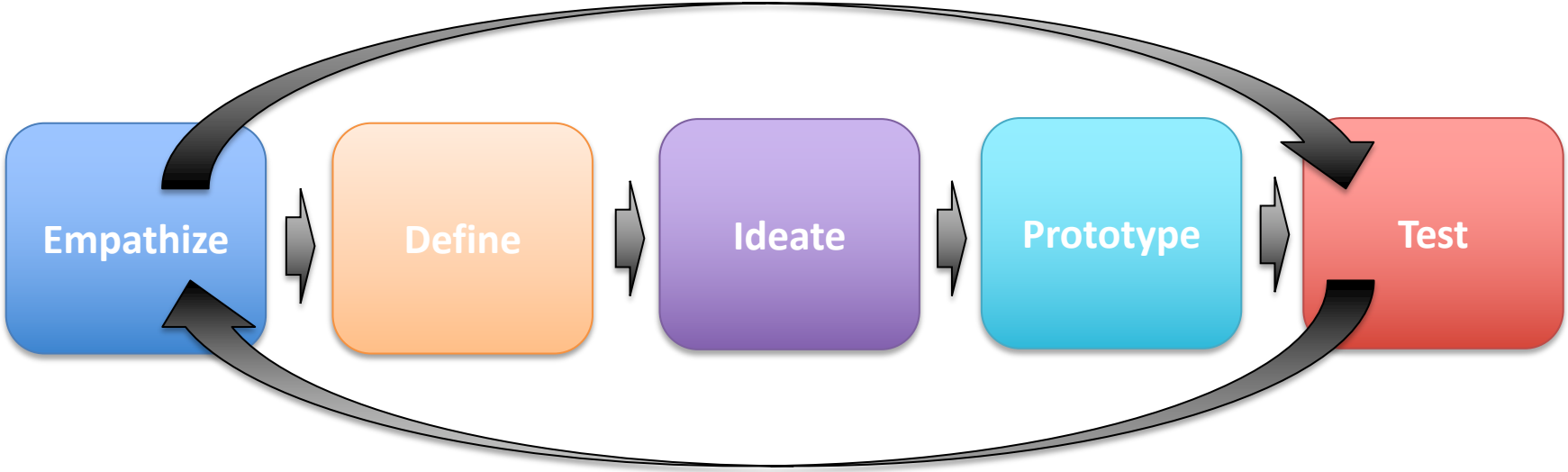
Human-centered approach

- A common trap of AI projects is leading with the solution, not the problem
- Design thinking is a human-centered methodology for creative problem solving
- The 3 E's of design thinking (Google):
  - **Empathy**
  - **Expansive thinking**
  - **Experimentation**

Design thinking process

Stanford's Design Thinking Process:



Empathize

- “You are not your user”
- Set aside your own assumptions and gain insight into your user’s needs
- Two primary methods
  - **Observe** – watch, listen
  - **Engage** - talk

Define

- Synthesize the information collected in the empathize stage
- Goal is to define a problem statement called a **point-of-view**
  - 3 elements: **user, need, insight**
- A good point-of-view is:
  - Human-centered
  - Narrow enough to be manageable
  - Not so narrow as to dictate the solution

Ideate

- Generate ideas of ways to solve the problem
- Goal is to identify a wide range of potential solutions
- Separate development of ideas from evaluation of them

Prototype

- Build prototypes to answer questions / test hypotheses
- Should be quick and cheap – wireframes, mockups, screenshots

Possible approach to model-based prototypes:

	Round 1	Round 2	Round 3	Round 4	…
Application	Mockup	Prototype	Prototype	Prototype	…
Data	Mockup	Limited subset	Limited subset	Limited subset	…
Model	Mockup	Mockup	Heuristic	Simple model	…

Test

- Get feedback on your solution concepts
- Put prototypes in the hands of users and let them interact
- Analyze feedback, adjust prototype and/or problem statement, and iterate

Why use design thinking?

- Ensures the **user** and **problem** are the focus of the project, not the technology
- Aligns all project team members on a common direction
- Validates whether we even need to apply AI to solve the problem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Task Analysis
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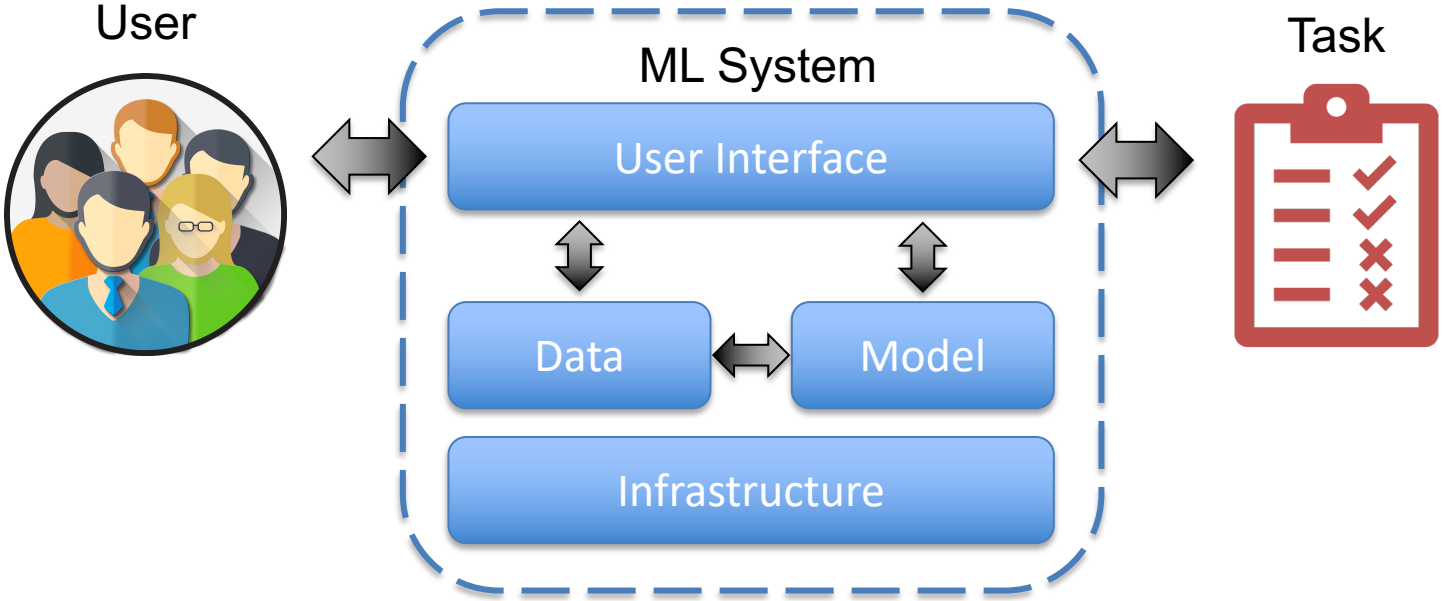
User – interface - task



User – interface - task

Task analysis

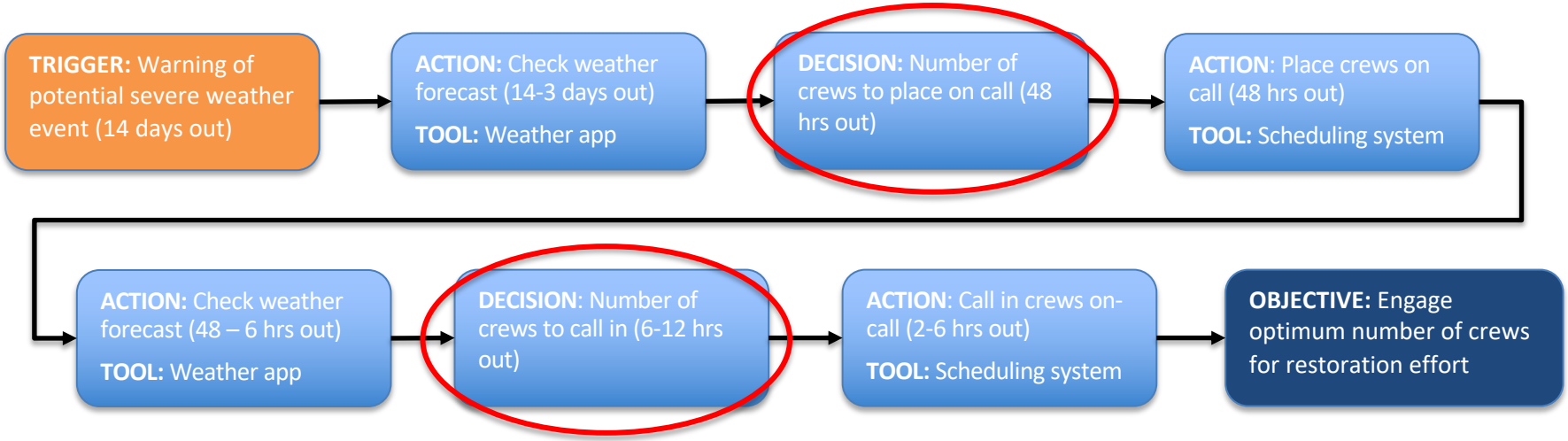
- Analysis of the step-by-step details of a user's task flow
- **Why?**
  - Ensures understanding of user's problem
  - Reduces bias from preconceived assumptions
  - Provides insight into steps that can be improved
- **How?**
  - Observation – trigger, goal, decisions, tools
  - Diagram the task flow

Optimizing the task

- Work backwards – start with the user's objective
- Find ways to eliminate or simplify steps
  - Reduce the user's physical or cognitive load
- Translate opportunities to eliminate bottlenecks into problem statements

Example: Utility storm prep

- **User:** Manager/Director of Operations for an electric utility
- **Task:** Scheduling crews for storm restoration work

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AI User Experience Design Considerations
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UX design principles

Don Norman's 6 Principles of Interaction Design:

1. **Visibility:** the more important, the more visible
2. **Feedback:** communicate what action has been taken
3. **Constraints:** simplify the interface by limiting interaction options
4. **Mapping:** clear relationships between controls and effects
5. **Consistency:** consistent elements throughout experience
6. **Affordance** (clarity): attributes of items communicate purpose

AI specific considerations

- User inputs
- Transparency into model
- Communicating uncertainty
- Feedback loops


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User Inputs
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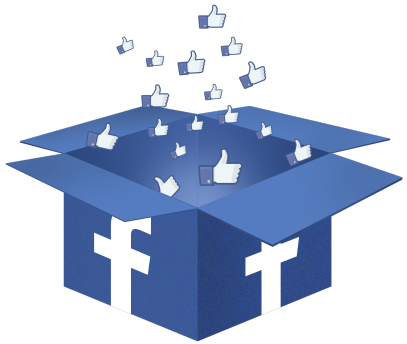
User inputs

- We generally need to collect data from our users for use in the model
  - **Forms**
  - **Uploads** (files, data)
  - **Votes/ratings**
  - **Actions** (clicks, purchases)
- The data collection should
  - Be an integrated part of the user's workflow
  - Ideally provide the user some benefit



Cold start problem

- If we are relying on user-supplied data for our model, we may initially not have enough to build a quality model
- This is particularly challenging with recommendation systems
- Options:
  - Use a heuristic-based approach
  - Add a calibration step to gather data

Communicating around inputs

- When we collect data, we must communicate to users:
  - **What is being collected?**
  - **For what purpose?**
  - **How can they view? Correct? Delete?**

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Transparency

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Transparency in use of AI

- ML models exist in the world all around us
- Some are exposed to us, others are hidden

- **Transparency considerations:**
  - Where AI exists / what it does
  - What data it uses
  - How it reaches its output
  - Limitations

Transparency into the model

- How much transparency to provide into how the model works?
- Depends on the significance of the use case:

Situation A:

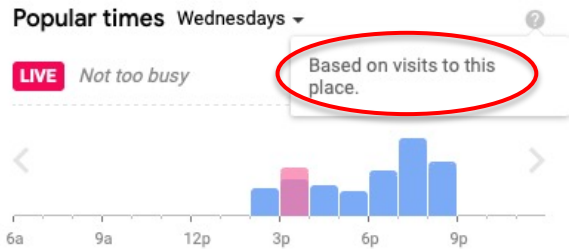
A model that auto-corrects your email text

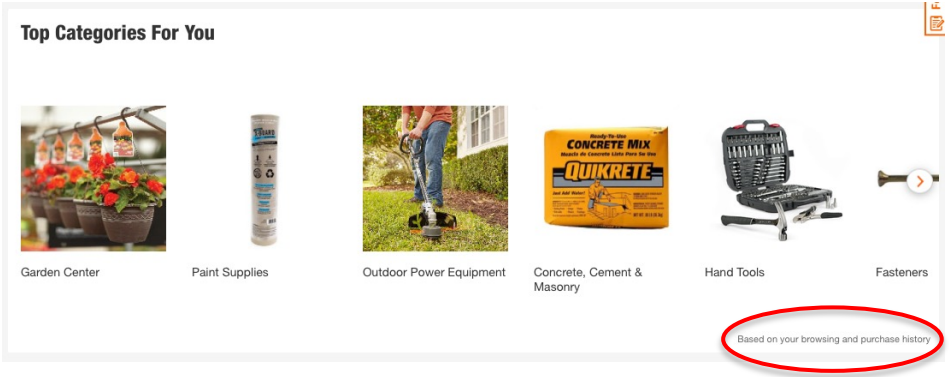
Situation B:

A model that calculates your risk level for mortgage approval

How to provide transparency

- Cite data sources / attributes used
- Give insight into importance of attributes
- Provide basis for model output
  - Why did you do that?
  - Why not something else?



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Communicating
Uncertainty
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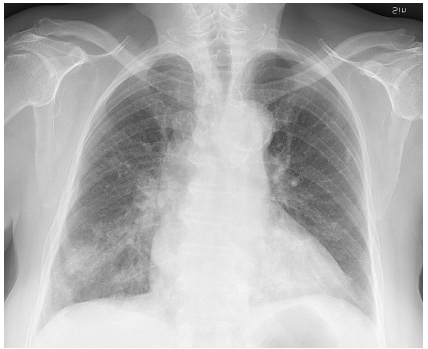
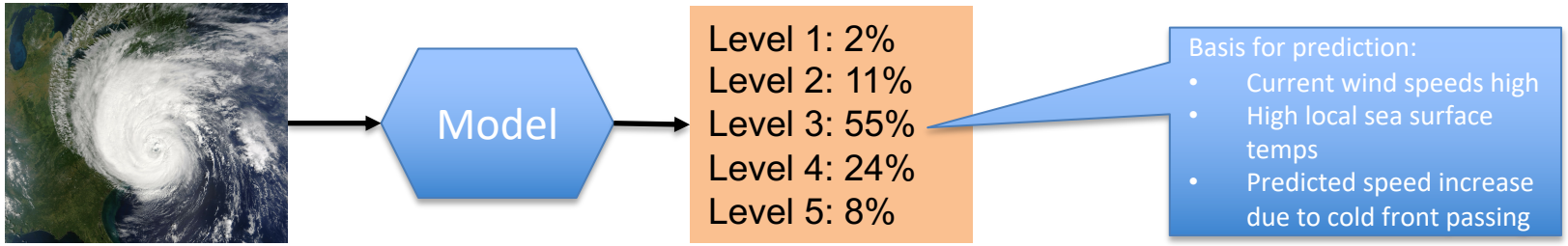
Deterministic vs. probabilistic

- ML system outputs are inherently probabilistic
- We can either convert these to deterministic outputs, or expose the uncertainty to the user
- Choice depends on the value of the probabilistic information for decision-making



Uncertainty in classification

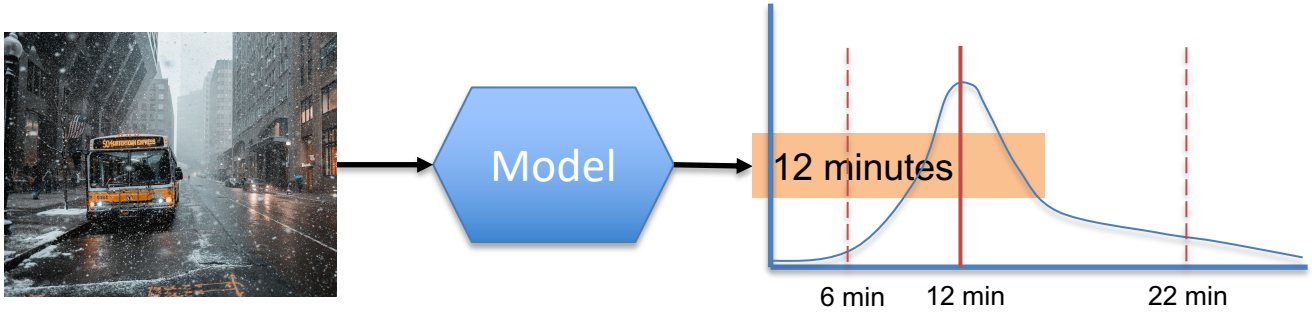
Uncertainty in classification



- We can present the **probabilities of each class** to the user
- We can provide **explanation for the predicted class**
  - Key features driving the prediction

Uncertainty in regression

Uncertainty in regression



- Point estimates can convey false precision
- Conveying uncertainty enables users to make informed decisions
  - Confidence interval (e.g. 95% confidence interval)
  - Prediction interval: how likely is the prediction to be within a certain range
- Tradeoff between precision and ease of interpretation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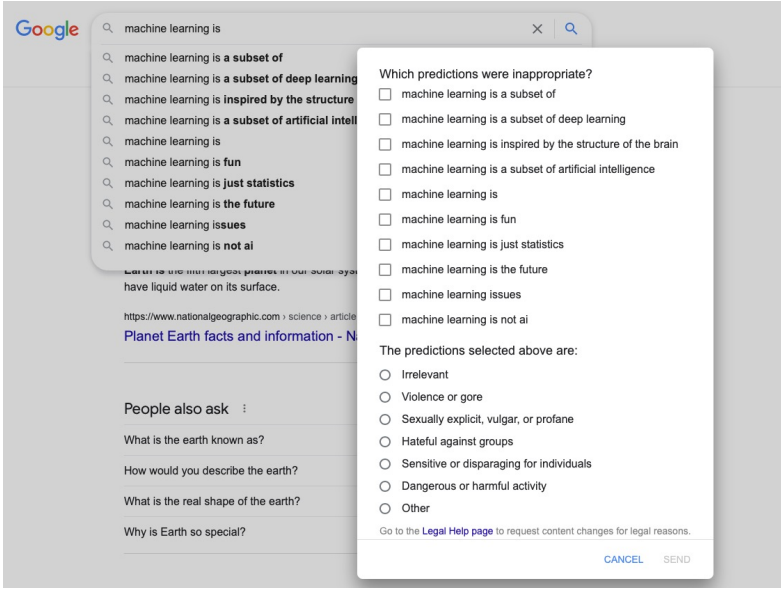
Feedback loops

- Many ML systems employ feedback loops where user interactions with a model influence the outputs they (and others) see over time
- Feedback loops can be:
  - **Explicit:** based on direct user feedback
  - **Implicit:** based on user actions as a result of model
- Can be useful to improve performance but can also propagate biases

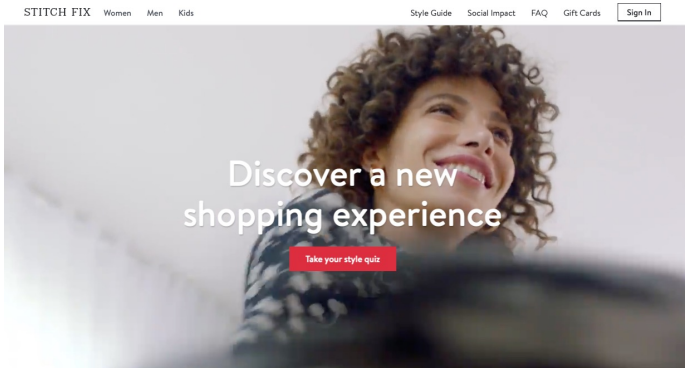
Explicit feedback loops

- System requests feedback from the user on the output quality
- Feedback used to re-train model for improved performance
- Can allow models to adapt to evolving data and new patterns, slowing decay rate



Implicit feedback loops

- Feedback loops which use users' behavior as proxy for target label
  - Clicks, purchases, likes, etc.
- Particularly common with recommendation systems

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Wrap-up
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Wrap Up

- A human-centered design approach is critical to a successful AI product
  - **Design thinking** and **task analysis** are two proven approaches
- AI products have unique UX design considerations:
  - Transparency into model
  - Communicating uncertainty
  - Feedback loops