

elevated  
third

# What's for Dinner?

Using Predictive UX to Help Users Decide

## About Us



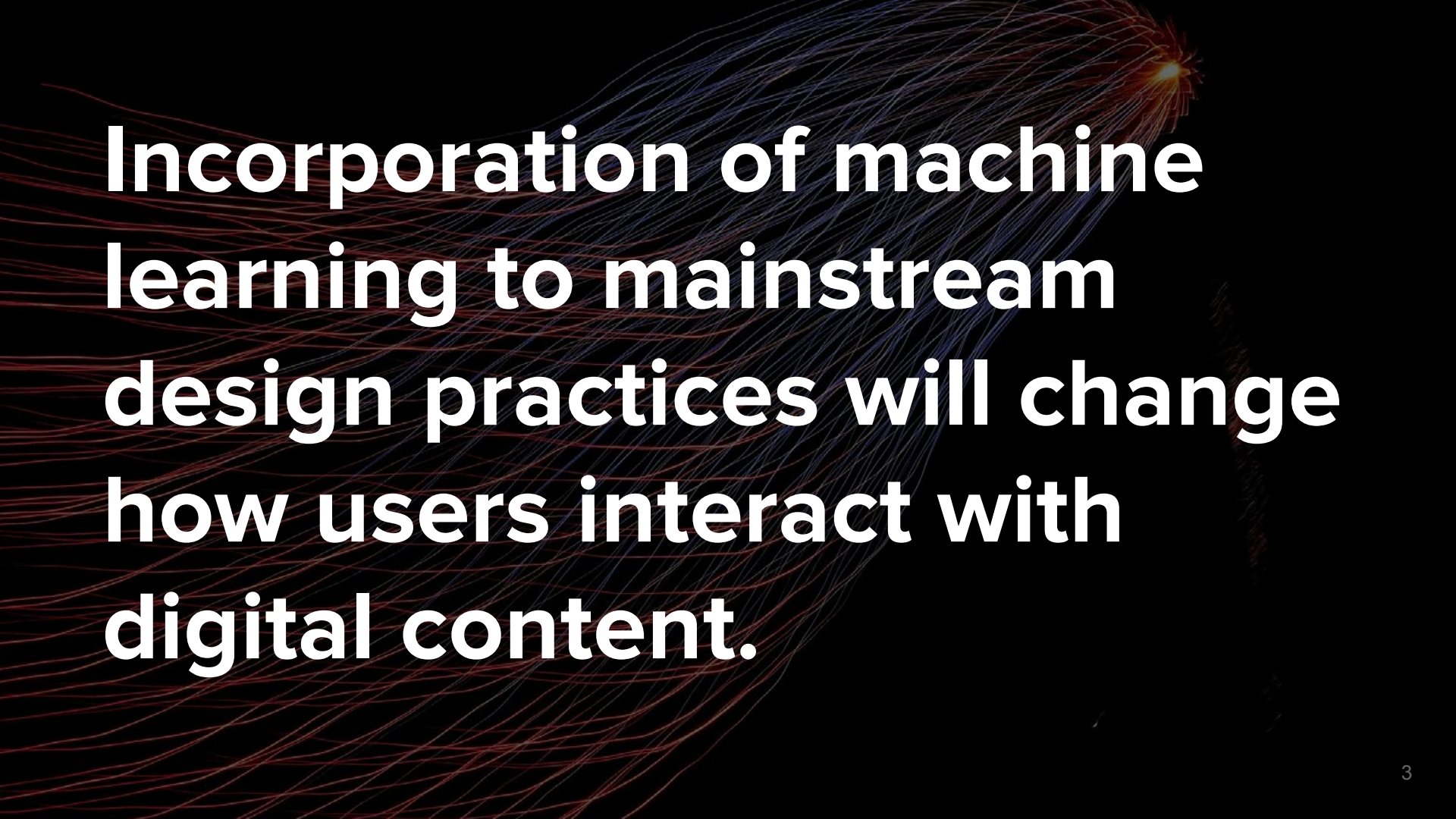
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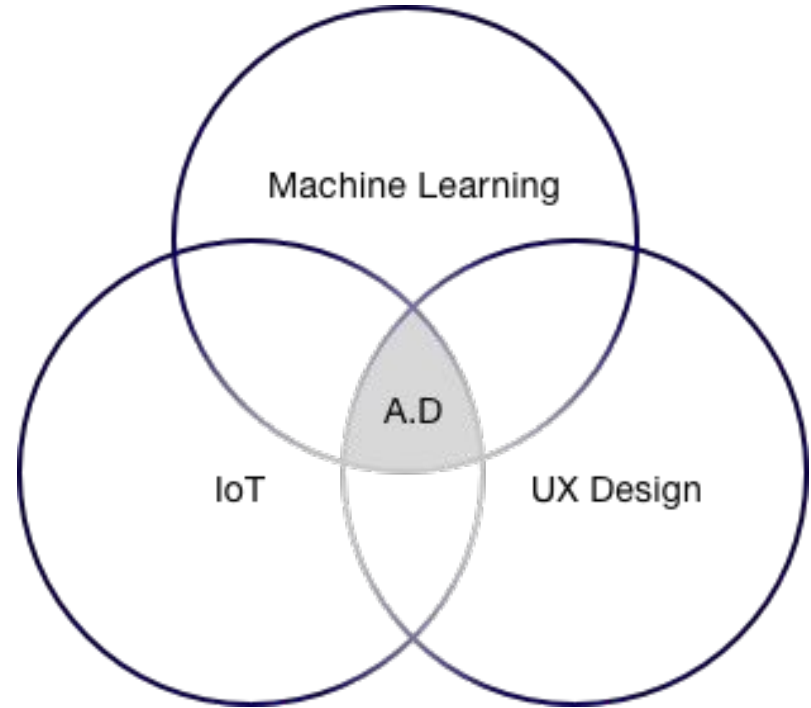


**Incorporation of machine learning to mainstream design practices will change how users interact with digital content.**

## Basic Concept

**“... A design pattern that moves around learning, predicting and anticipating.”**

— Joël van Bodegraven



| Essentially ...

**“Personalization is done by the system being used. Developers set up the system to identify users and deliver ... the content, experience, or functionality that matches their role.”**

— Amy Schade, Nielsen Norman Group

## What is Predictive UX?



# What is Predictive UX?

The screenshot shows the GrubHub mobile app interface. At the top, there's a red header with the GrubHub logo, location (Denver, CO), a search bar containing "Indian, sushi, Pizza Parlor", and user profile information (Hi, Laurent). Below the header, there are filter sections for "I want" (Delivery/Pickup), "Feature" (Free Delivery, Order Tracking, Open Now), "Rating" (star selection), "Price" (\$ to \$\$\$\$), and "Delivery time" (45 min, 60 min, Any). The main content area is titled "Browse food near you" and shows a grid of restaurant categories (Lunch, Sandwiches, Asian, American, Salads, Pizza, Healthy, Japanese, Sushi, Hamburgers, Mexi) and a list of restaurant results. Each result includes a restaurant name, cuisine, ratings, price range, and delivery time.

Restaurant	Cuisine	Ratings	Price Range	Delivery Time
Freshcraft	American, Pub Food	Not enough ratings	\$5-\$5	0.89 mi • 45-55 min
Pizza & Grill	Grill, Hamburgers...	3163 Ratings	\$5-\$5	0.55 mi • 50-60 min
P.F. Chang's Downtown	Asian, Chinese...	992 Ratings	\$5-\$5	0.86 mi • 30-40 min
Thai Basil	Asian, Thai	1797 Ratings	\$5-\$5	1.18 mi • 50-60 min
Protein Bar and Kitchen	Healthy, Lunch Specials...	123 Ratings	\$5-\$5	0.89 mi • 45-55 min
Nicola's Chicago Style Pizza	Lunch Specials, Pizza...	1790 Ratings	\$5-\$5	0.93 mi • 50-60 min
Brothers BBQ (Washington St)	BBQ, Lunch Specials	1370 Ratings	\$5-\$5	1.15 mi • 35-45 min
Pepper Asian Bistro	Asian, Chinese...	4275 Ratings	\$5-\$5	1.93 mi • 45-55 min
Red Ginger	Asian, Japanese...	1345 Ratings	\$5-\$5	0.98 mi • 60-70 min
Ebert & Gerbert's Sandwich Shop	Gluten-Free, Lunch Specials...	669 Ratings	\$5-\$5	0.83 mi • 25-35 min
Little India Restaurant & Bar (E 6th Ave)	Indian, Indian	2114 Ratings	\$5-\$5	minimum

The screenshot shows a restaurant delivery app interface. At the top, there's a red header with a menu icon, a search bar, and a shopping cart icon. Below the header, there's a large blue promotional banner that says "Free delivery all month!" and "No delivery fee on your first order and all orders for 30 days. Promo applied at checkout." Below the banner, there's a section titled "All Restaurants" which lists several restaurants with their logos, names, descriptions, and delivery times.

Restaurant	Description	Delivery Time
McDonald's	Fast Food, Burgers, Sandwiches, American (Traditional), American (New), Breakfast & Brunch	34 mins
Taco Bell	Mexican, Fast Food, Late Night	33 mins
Subway	Fast Food, Sandwiches, Lunch, Salads	55 mins
DiCicco's	Italian	50 mins
Village Inn	American Diner	46 mins
Tower Tap & Grill	Salads, Desserts, American (Traditional)	

**|** Cognitive Load Exercise

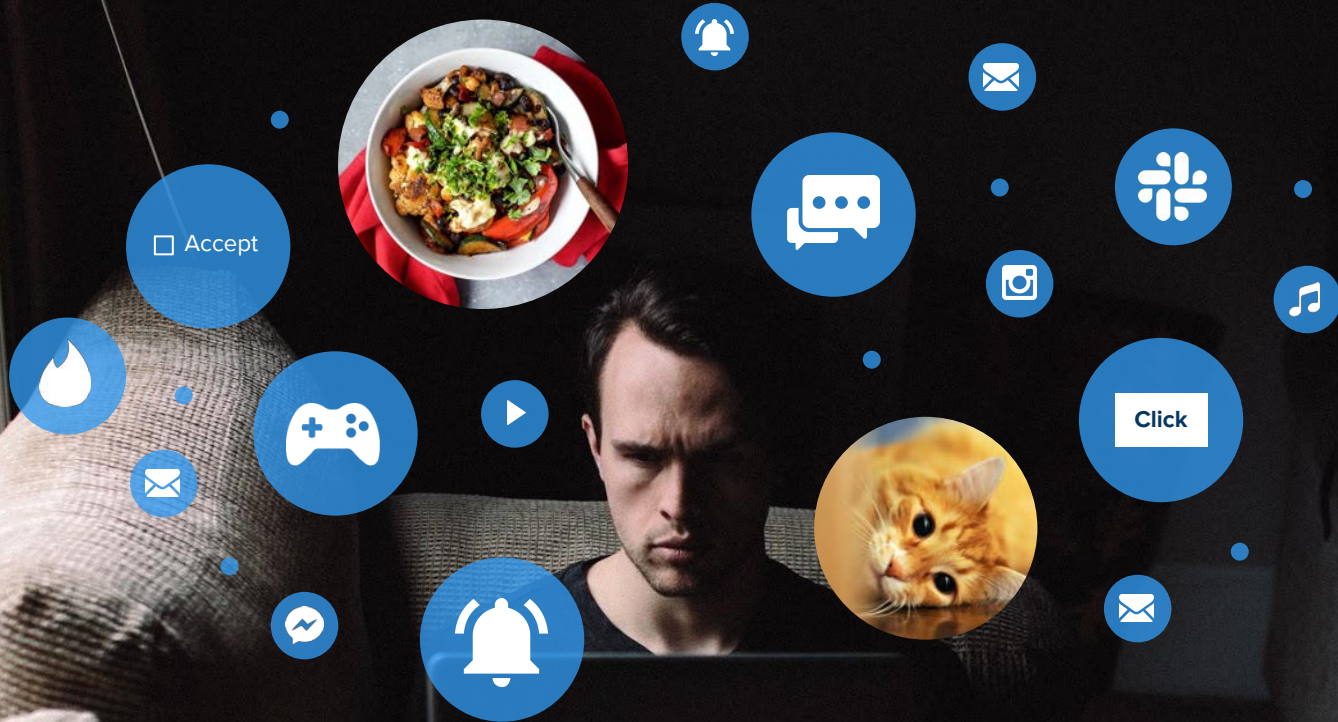
**WO UIB MES LUS A**

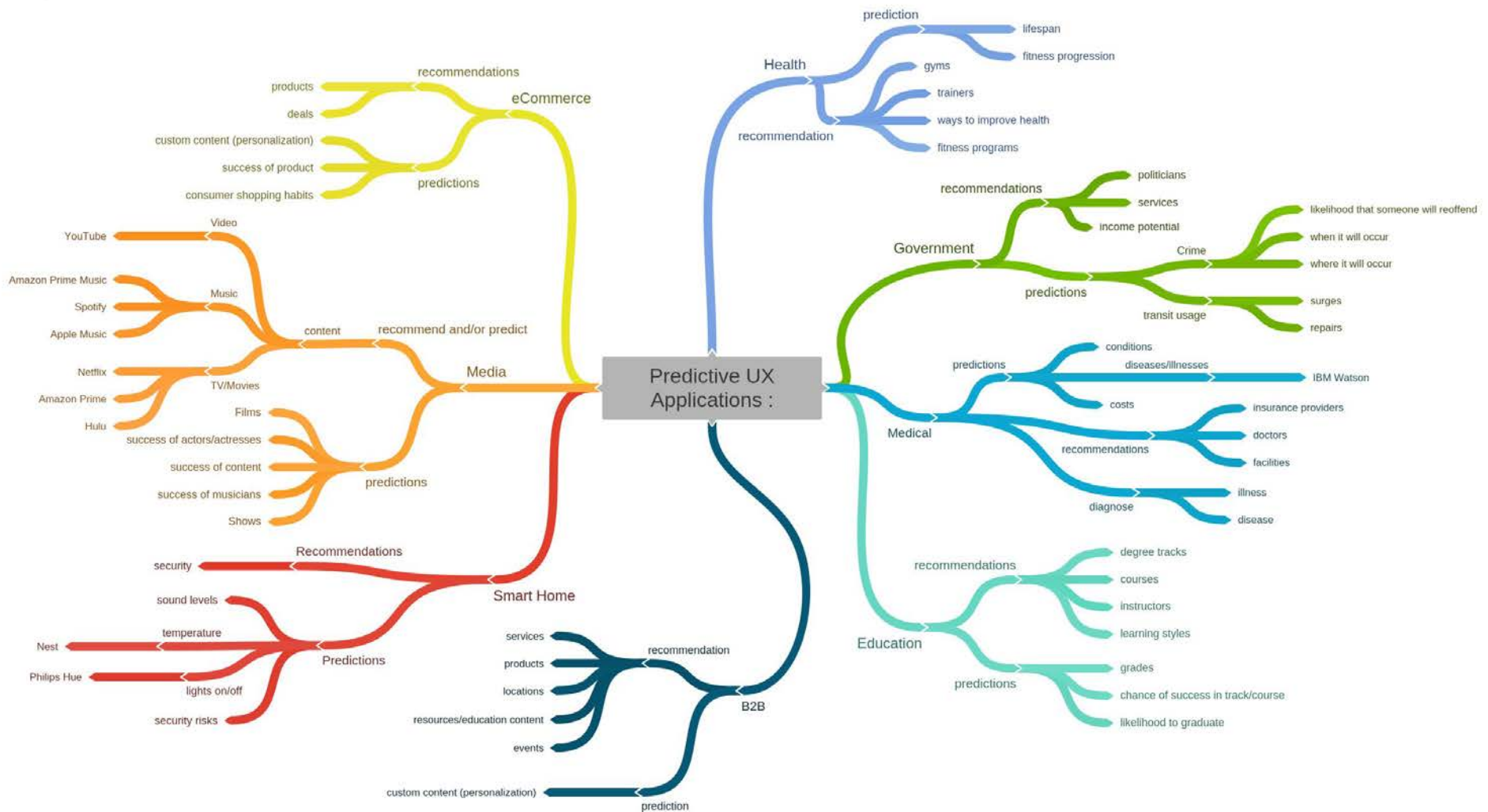


**Write down the sequence of letters  
as you remember it**

**How did you do?**

# Cognitive Load Theory







# Machine Learning Powers the End User Experience

**Machine learning is the science of getting computers to do things (and learn and improve) **without being explicitly programmed.****

Who's doing It?

amazon

NETFLIX

hulu

nest

  
Spotify®

Google

## Machine Learning

1

**Define your  
problem in  
machine  
learning terms**

2

**Collect training  
data in a  
suitable format**

3

**Build a model  
(or a set of  
models)**

Example

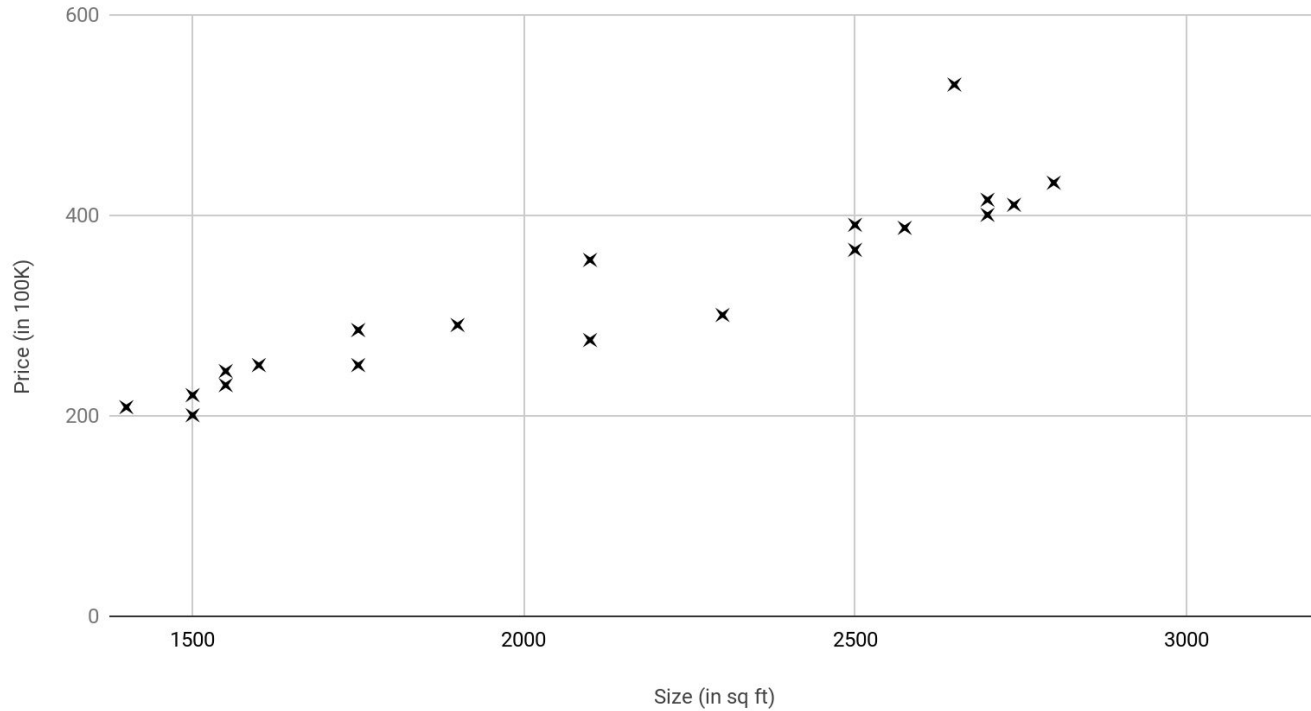
**Predicting the price of a house, given its square footage.**





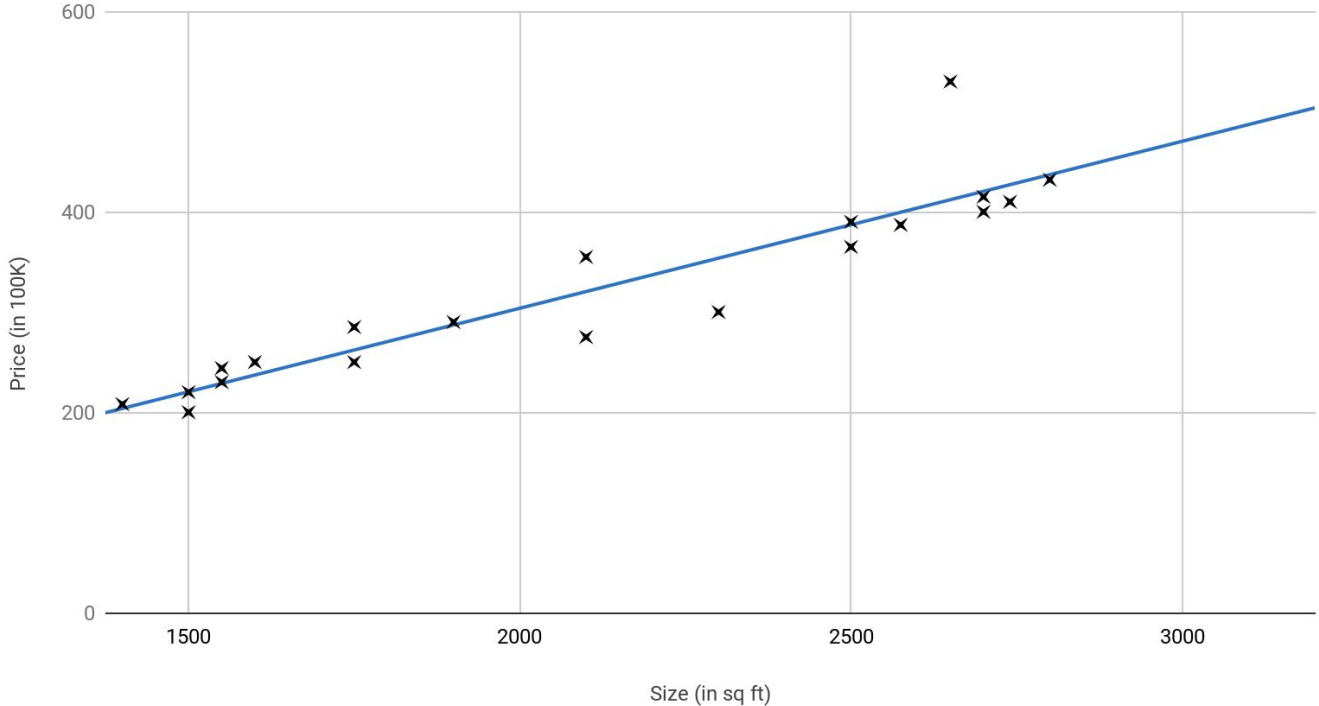
# Machine Learning

Home Price vs. Size



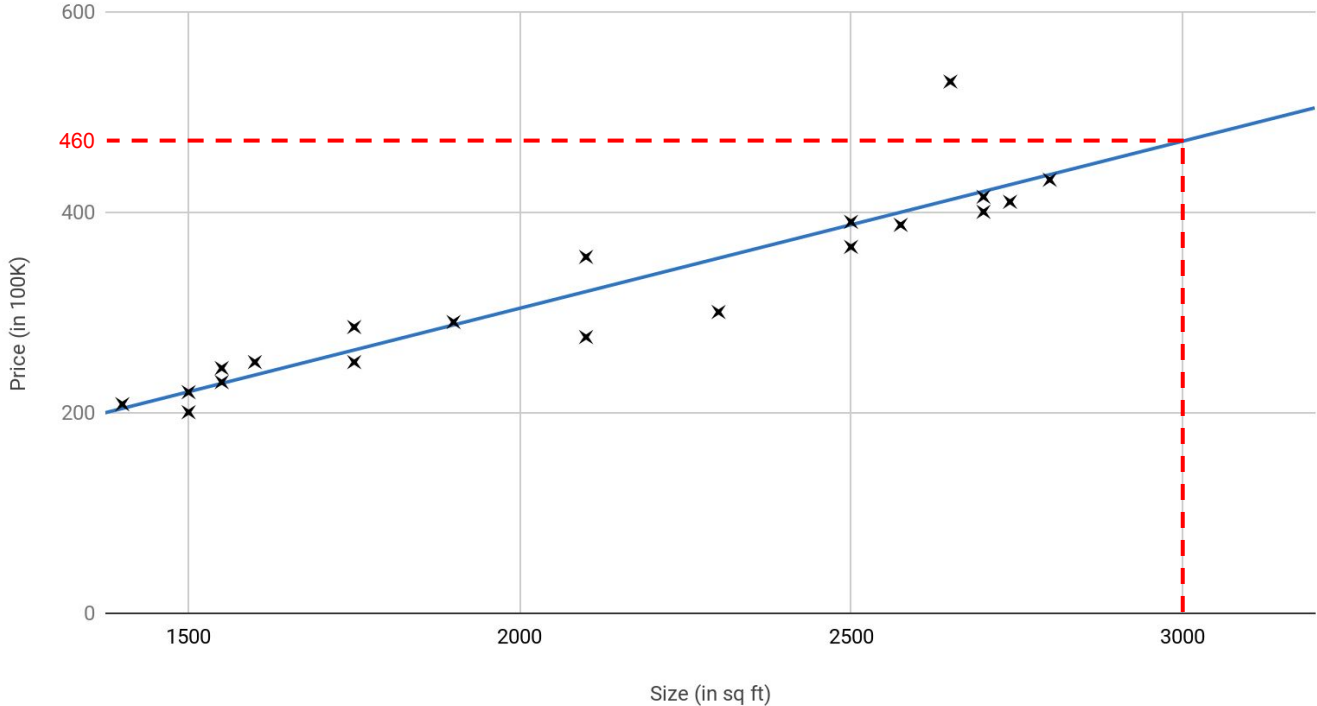
# Machine Learning

Home Price vs. Size



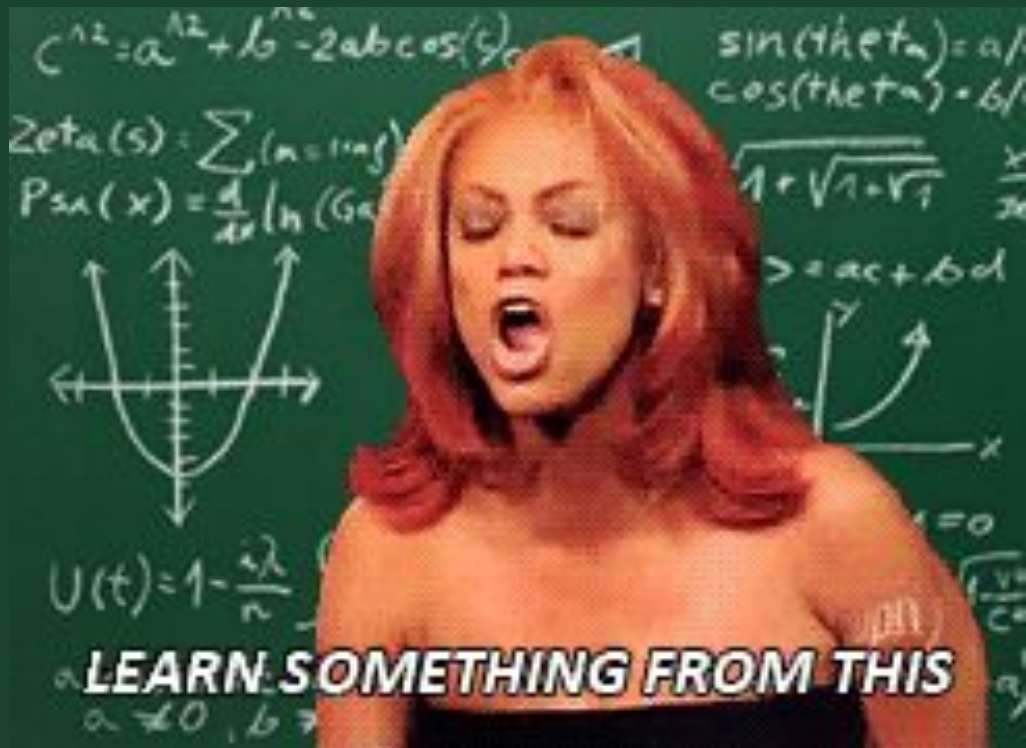
# Machine Learning

Home Price vs. Size



Congrats!

You just  
learned Linear  
Regression



**For our use case, it is clear that we need a recommendation system.**

**Recommenders are a subclass of machine learning techniques that aim to predict a user's preference.**

## Example

# Content-Based Recommendation

- You have features that can capture the characteristics of an item (eg. the genre of a song).
- Recommend other items with similar characteristics.



## Example

# Collaborative Filtering

- Make recommendations based on preferences of other users with similar tastes (collaboration).
- The features of items themselves are not important.

The screenshot shows the Amazon product page for "The Hundred-Page Machine Learning Book" by Andrey Burkov. The page features a main product image, a description, and several recommendation sections. A pink bracket on the left side of the image highlights the recommendation sections.

**Product Details:**  
Title: The Hundred-Page Machine Learning Book Hardcover – January 11, 2019  
Author: Andrey Burkov (Author)  
Rating: 5 stars (58 customer reviews)  
Best Deal: Kindle \$34.99, Hardcover \$47.50 (prime), Paperback \$37.99 (prime)

**Customers who bought this item also bought** (Page 1 of 8):

- Linear Algebra and Learning from Data by Gilbert Strang: Hardcover, \$74.70 (prime)
- Math for Machine Learning: Open Doors to Data Science and... by Richard Han: Paperback, \$18.99 (prime)
- Loomshots: How to Nurture the Crazy Ideas That Win Wars, Cure Diseases, and... by Sari Hattar: Hardcover, \$15.00 (prime)
- Tribion Dollar Coach: The Leadership Playbook of Silicon Valley's Bill Campbell by Eric Schmidt: Hardcover, \$18.89 (prime)

**Customers who viewed this item also viewed** (Page 1 of 10):

- Daily Coding Problems by Lawrence Wu: Hardcover, \$4.95 (prime)
- Deep Learning with Python by François Chollet: Hardcover, \$49.99 (prime)
- Heard in Data Science Interviews: Over 650 Most Commonly Asked... by Kat Mishra: Hardcover, \$9.99 (prime)
- Math for Machine Learning: Open Doors to Data Science and... by Richard Han: Hardcover, \$18.99 (prime)
- Introduction to Deep Learning (The MIT Press) by Eugene Charnik: Hardcover, \$24.95 (prime)
- Grokking Deep Learning by Andrew Ng: Hardcover, \$44.95 (prime)

## Example

It is very common to have **hybrid recommender systems**, using a combo of both content-based and collaborative filtering.

The image shows a screenshot of the Spotify web interface. The top navigation bar includes links for FEATURED, PODCASTS, CHARTS, GENRES & MOODS, NEW RELEASES, and DISCOVER. The main content area is divided into several sections:

- Made for you:** A grid of personalized playlist and album covers, including "Your Discover Weekly", "Your Release Radar", "Your Daily Mix 1-4", "Your Daily Mix 5-6", "Your Time Capsule", "Your Top Songs 2018", and "Tastebreakers".
- Recently played:** A grid of album covers for tracks recently played, such as "2019, 31", "Strange Trails" by Lord Huron, "This Is Lord Huron", "New Music Friday", "Hold On" by Crooked Colours, and "Hi This Is Flume (Mixtape)".
- More like London Grammar:** A row of circular profile pictures of artists similar to London Grammar, including a man with a hat, a person in a dark coat, and several other artists.

The left sidebar shows the user's profile "Lauren Mott" and a list of recently played items, including the "2019, 31" playlist and "Strange Trails" album.

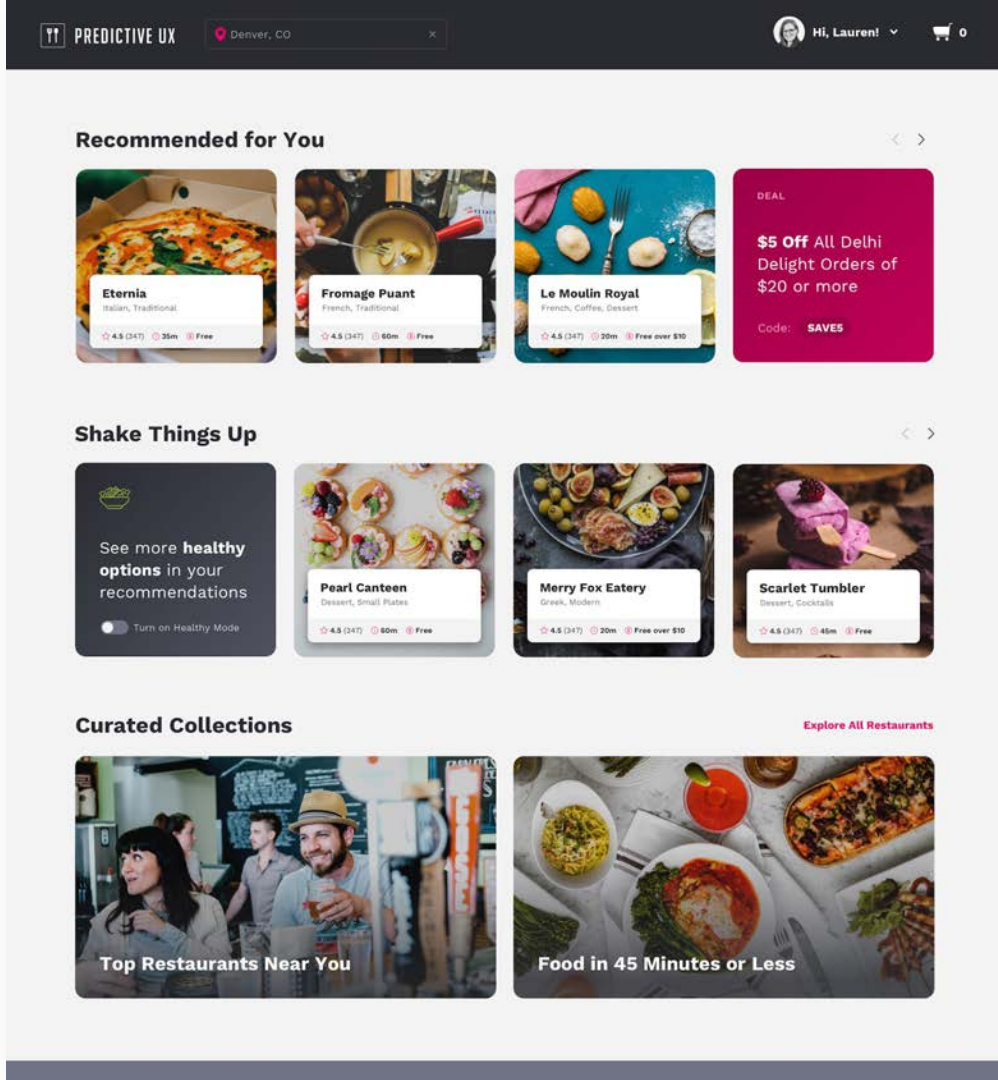


The background features a dark, starry space scene with numerous thin, orange and red light trails. These trails originate from a central point at the bottom and fan out towards the top right, creating a sense of motion and depth. The overall aesthetic is futuristic and dynamic.

# UX Principles of Predictive UX

## Keep It Simple

Create minimal interfaces with just enough content + design elements for the user's needs



## Resist the Filter Bubble

**“We increasingly live in a “filter bubble”: The information we take in is so personalized that we’re blind to other perspectives.”**

— Drake Baer, The Cut • Nov 9, 2016

The image is a screenshot of a Facebook news feed. At the top, there's a search bar and navigation icons. The main content area shows a post from 'Lauren Moti' with the text 'What's on your mind, Lauren?'. Below this is a 'Your Facebook Memories' section, which features a large image of a lake with trees and a wooden dock, and a smaller image of a house. The text for the memories post reads: 'Lauren, we care about you and the memories you share here. We thought you'd like to look back on this post from 2 years ago.' To the right of the main feed is a 'Stories' section with a '+ Add to Your Story' button and three story thumbnails. Below the stories is a 'Sponsored' section with an advertisement for 'asana' that says 'Less guesswork. More great work.' and 'Try for free asana.com'. The ad includes an illustration of a person and a photo of a house. At the bottom of the screenshot, there's a partial view of another post from 'Hey girl, how YOU doing?' with a photo of a dog on a bed.

# Resist the Experience Bubble

Home

Browse

Radio

YOUR LIBRARY

Made For You

Recently Played

Songs

Albums

Artists

Stations

Videos

Podcasts

PLAYLISTS

Deep/Dark Trance & House

Years

2019, 31

2018, 30

2017, 29

2016, 28

2015, 27

Chill

Exospheres

Deep House Relax

Movement

10 items

+ New Playlist

Hold On +  
Crooked Colours

0:18

4:06

Search

Lauren Motl

## Browse

OVERVIEW PODCASTS CHARTS GENRES & MOODS NEW RELEASES DISCOVER MORE

### Similar to ODESZA

More Colors  
Kidswave

Coming Up  
SG Lewis

Show Me  
Big Wild

Suffer | Safe  
Petit Biscuit

### Similar to Beirut

Crack-Up (Choral Version) /  
In The Morning (Live in...)  
Fleet Foxes

The End of the World  
Sharon Van Etten

Shields: B-Sides  
Grizzly Bear

Record Store Day 2011 -  
Single  
The Dodos

Search

Lauren Motl

## Made For You

PLAYLIST • BY SPOTIFY

### Your Daily Mixes

Your Daily Mix 1

Your Daily Mix 2

Your Daily Mix 3

Your Daily Mix 4

Daily Mix 1  
Tourist, Big Wild, Lane 8 and  
more

Daily Mix 2  
Foreign Air, St. Lucia, VHS  
Collection and more

Daily Mix 3  
Clairo, Tomppabeats, Jorja  
Smith and more

Daily Mix 4  
Blind Pilot, Tennis, Sylvan Esso  
and more

### Even More

Your Top Songs 2018  
The songs you loved most this  
year, all wrapped up.

Tastebreakers  
Start 2019 by broadening your  
horizons. We've made you a  
playlist of songs from genres...

Your Time Capsule  
We made you a personalized  
playlist with songs to take you  
back in time.

Your Top Songs 2017  
The songs you loved most this  
year, all wrapped up.  
PLAYLIST • BY SPOTIFY

0:04

3:02

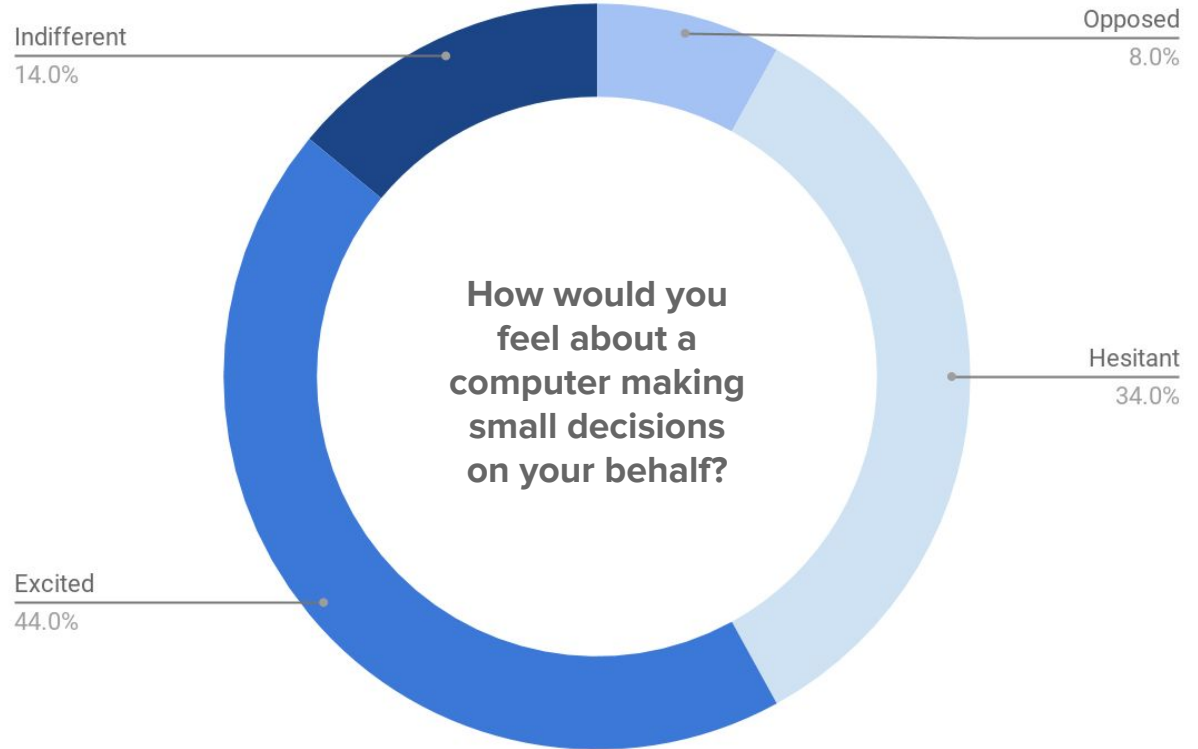
Predictive != Control

**“Predictive” does not mean the same thing as “Control.”**



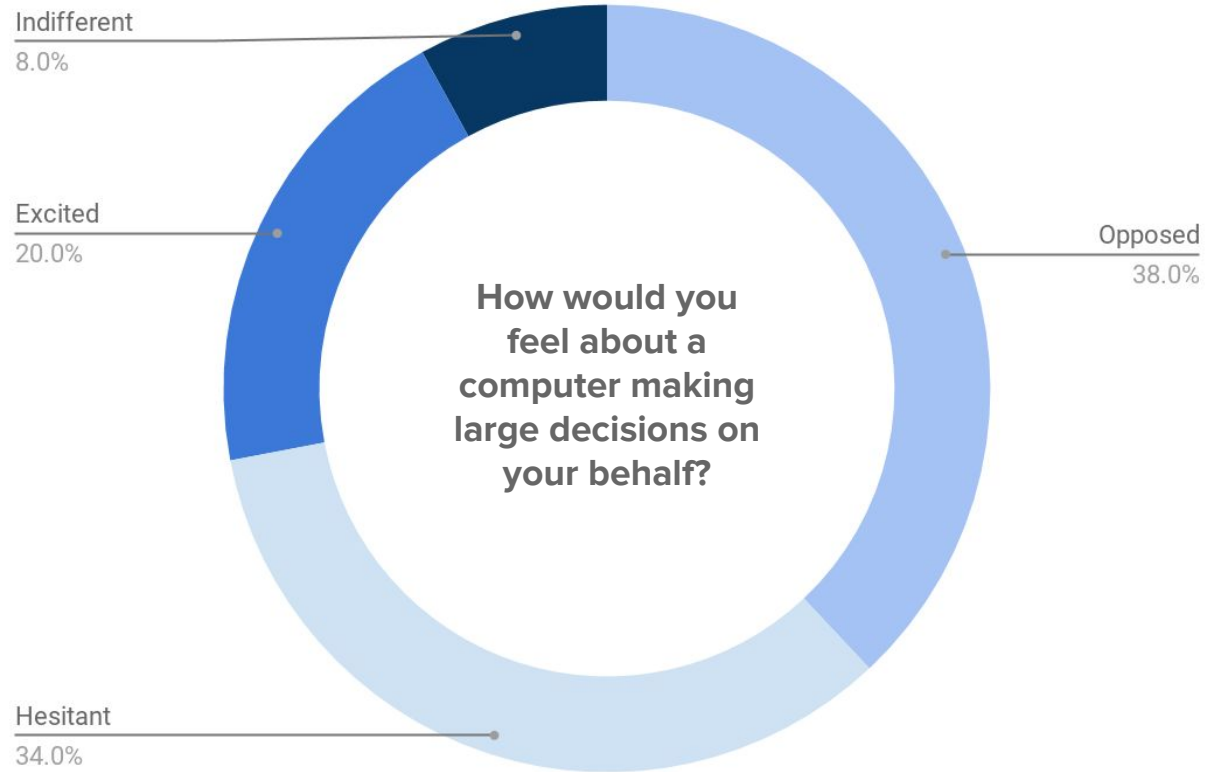
## Predictive != Control

**44% said they  
were excited by  
this idea**



**Predictive != Control**

**20% said they were excited by this idea**



Questions?


## What We've Covered

- What is Predictive UX + how does it benefit users?
- How Machine Learning Powers Predictive UX
- UX principles

## What's Next

- How we implemented Machine Learning in Drupal
- Things to Consider/Challenges



An aerial night view of a dense city, likely New York City, showing numerous skyscrapers with many windows illuminated. The scene is dark, with the city lights providing the primary illumination. The text 'Can This Be Built in Drupal?' is overlaid in white on the left side of the image.

# Can This Be Built in Drupal?

Can This Be Built in Drupal?

## Apache PredictionIO

- Open-source
- Full machine learning stack
- Customizable templates
- Easily deploy as web service



Recommenders Classification Regression **NLP** Clustering Similarity Other

### Cstablo-template-text-similarity-classification

Star 7

Text similarity engine based on Word2Vec algorithm. Builds vectors of full documents in training phase. Finds similar documents in query phase.

Support: [Github issues](#)

Type	Language	License	Status	PIO min version	Apache PIO Convesion Required
Parallel	Scala	Apache Licence 2.0	alpha	0.9.5	requires conversion

### Topic Labelling with Wikipedia

Star 9

This template will label topics (e.g. topic generated through LDA topic modeling) with relevant category by referring to Wikipedia as a knowledge base.

Support: [Github issues](#)

Type	Language	License	Status	PIO min version	Apache PIO Convesion Required
Parallel	Scala	Apache Licence 2.0	stable	0.10.0-incubating	already compatible

### Text Classification

Star 29

Use this engine for general text classification purposes. Uses OpenNLP library for text vectorization, includes t.f.-i.d.f.-based feature transformation and reduction, and uses Spark MLLib's Multinomial Naive Bayes implementation for classification.

Support: [Github issues](#)

Type	Language	License	Status	PIO min version	Apache PIO Convesion Required
Parallel	Scala	Apache Licence 2.0	alpha	0.11.0-incubating	requires conversion

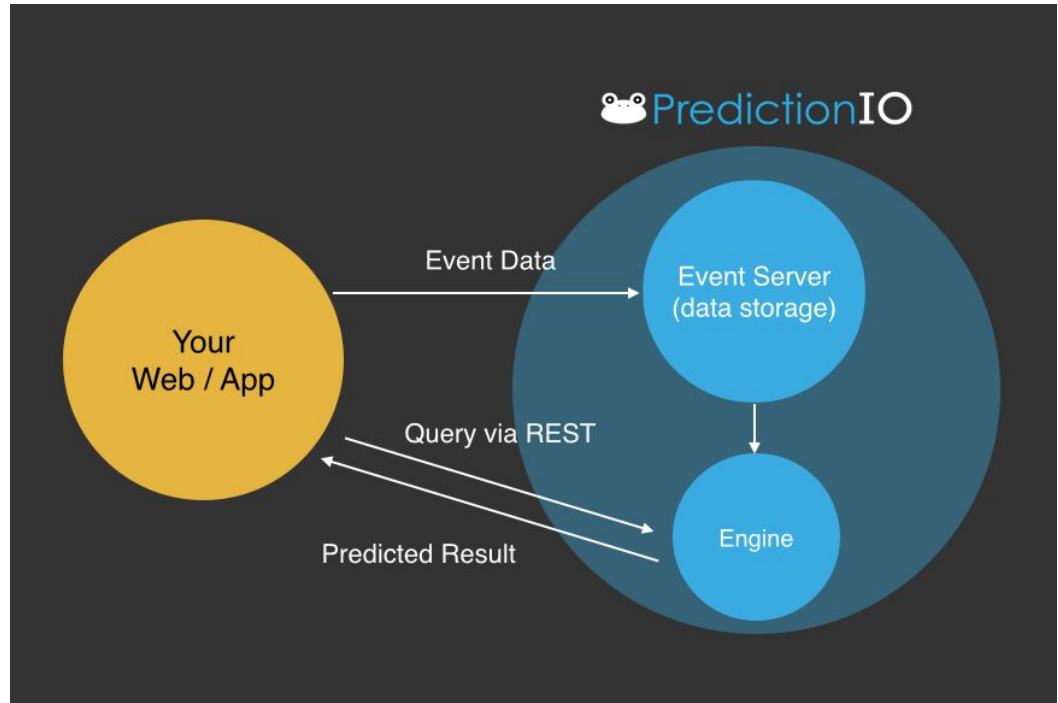
## Can This Be Built in Drupal?

### Event Server

Collects data from app and provides it to the engine.

### Engine

Reads training data and builds a predictive model using machine learning algorithms.



## Can This Be Built in Drupal?

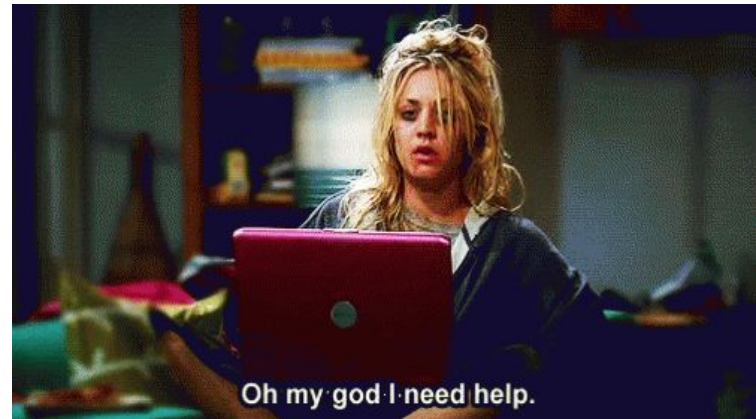
### Explicit Data

- User explicitly provides information, like rating or buying an item



### Implicit Data

- No explicit feedback; use information already available, like binge watching a show



# Demo

## Questions?

### What We've Covered

- What is Predictive UX + how does it benefit users?
- How Machine Learning Powers Predictive UX
- UX principles
- How we implemented Machine Learning in Drupal

### What's Next

- Things to Consider/Challenges



Things to Consider

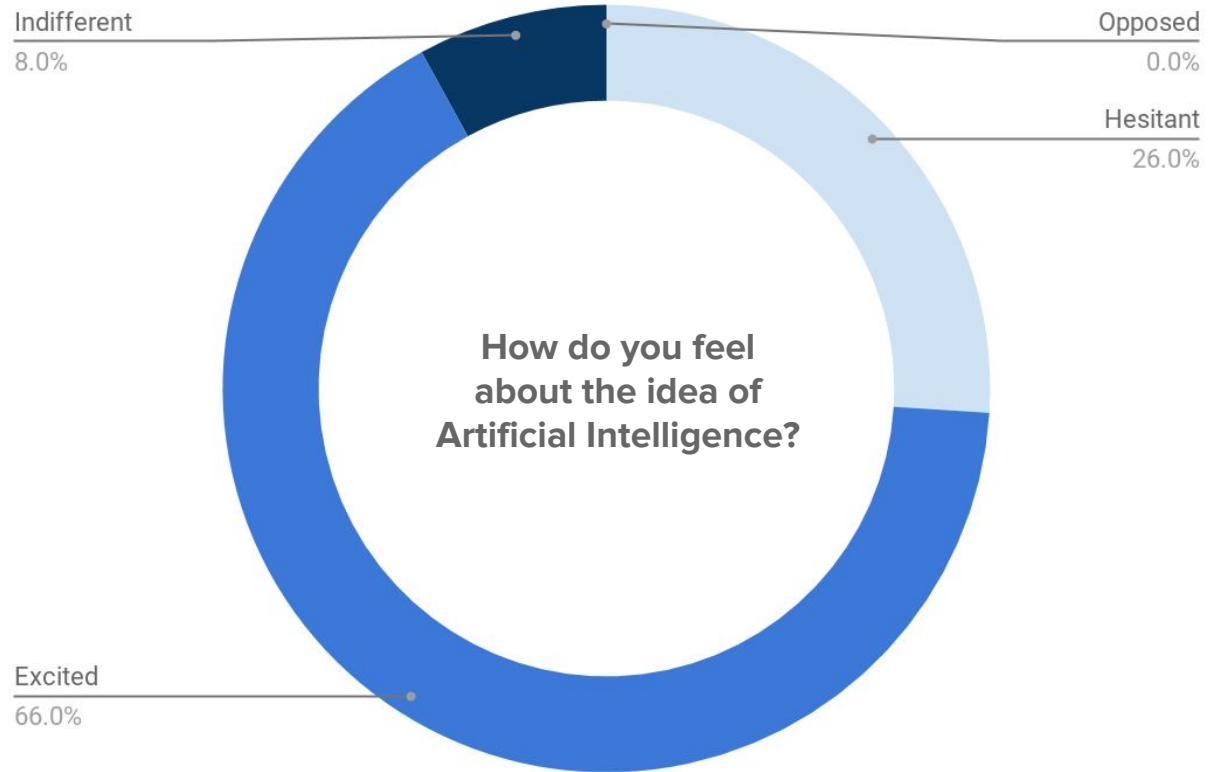
# Willingness to Adopt

**The technology is feasible. And UX is critical to the successful adoption of artificial intelligence and machine learning into society.**



## Willingness to Adopt

**66% of people  
are excited by  
the idea of  
artificial  
intelligence**





Things to Consider

# Hardware

**Crunching data takes up a lot of memory and server space. The options are to buy more server space, leverage APIs that come with it, or crunch less data to save space.**



Things to Consider

# Data is Fuel

## Cold Start Problem

Machine Learning systems need data, a lot of it



Explore All Restaurants



### Curated Collections

Explore All Restaurants



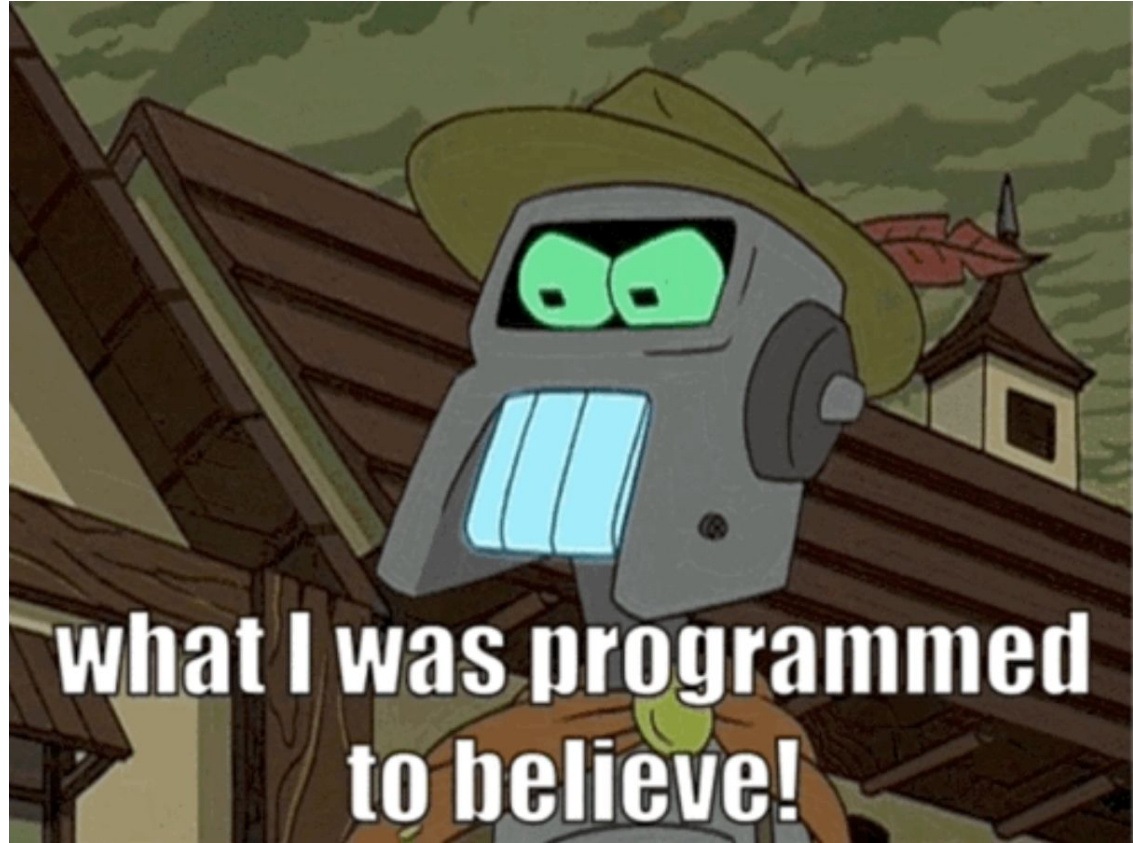


Things to Consider

# Machines Don't Have Values

Value Alignment  
Problem

**Algorithms are binary and can't make judgement calls. To a computer, all things are 1 or 0, black or white.**



# Value Alignment Problem

TECH 12/15/2014 01:42 am ET | Updated Dec 15, 2014

## Uber Raises Fares During Sydney Hostage Crisis, Then Offers Free Rides

ISSIE LAPDOWSKY BUSINESS 12.15.14 12:30 PM

## WHAT UBER'S SYDNEY SURGE PRICING DEBACLE SAYS ABOUT ITS PUBLIC IMAGE



Joel  
@MonocleMoose

Follow

@Uber\_Sydney @joshgnosis Absolutely disgraceful. You should be capping the prices much lower rather than taking advantage! Shockingly bad

2:38 AM - 15 Dec 2014

8 RETWEETS 6 FAVORITES

Reply Retweet Favorite



NEWS

## Uber's Surge Pricing Near Siege in Sydney Sparks Outrage

BBC

Sign in

News

Sport

Weather

Shop

Reel

Travel

Mor

Home

Video

World

US & Canada

UK

Business

Tech

Science

Stories

Entert

Technology

## Uber 'truly sorry' for price rise during Sydney siege



Uber Sydney  
@Uber\_Sydney



Follow

We are all concerned with events in CBD. Fares have increased to encourage more drivers to come online & pick up passengers in the area.

Reply Retweet Favorite More

RETWEETS  
682

FAVORITES  
184



2:35 AM - 15 Dec 2014



Tyson Armstrong @tysonarmstrong · 13h  
@uber\_sydney What a shameful disgrace.

Reply Retweet Favorite More



Rob @NotSureIGetIt2 · 13h  
@Uber\_Sydney Uber paying their drivers to get people out of the CBD safely free to the customer would have been better than \$100.

Reply Retweet Favorite More

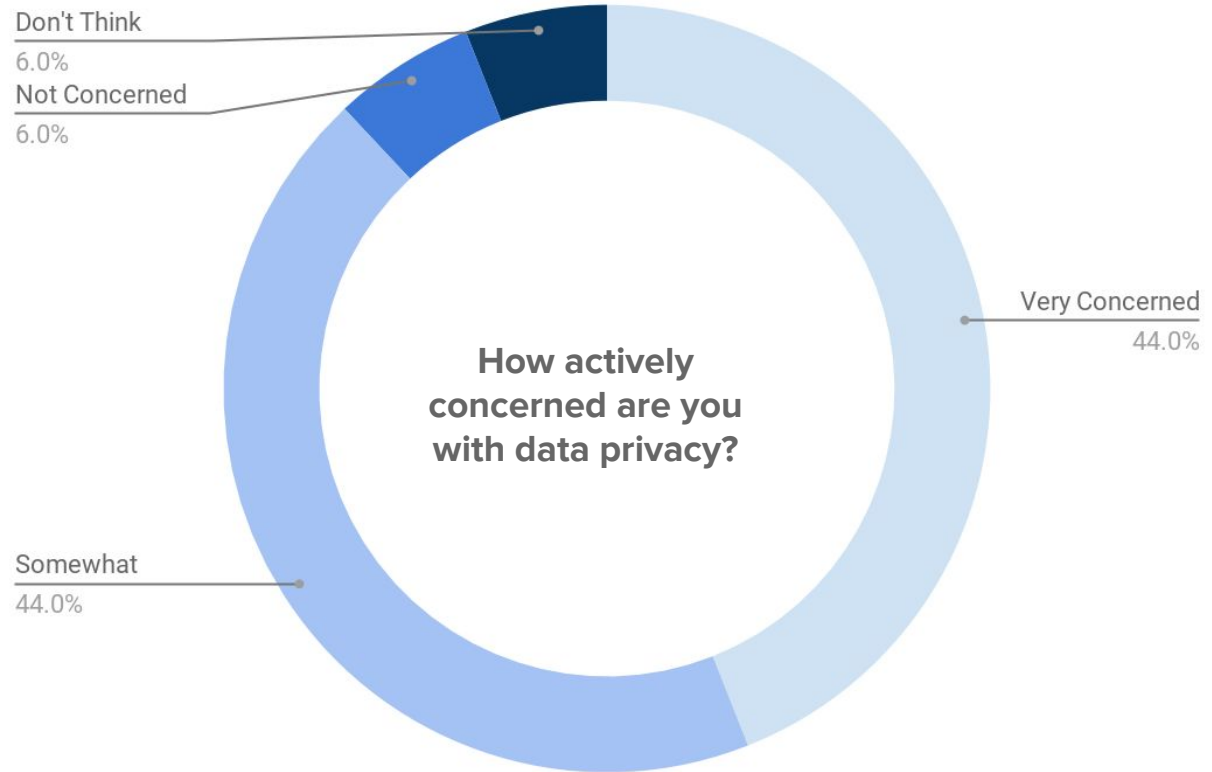




Things to Consider

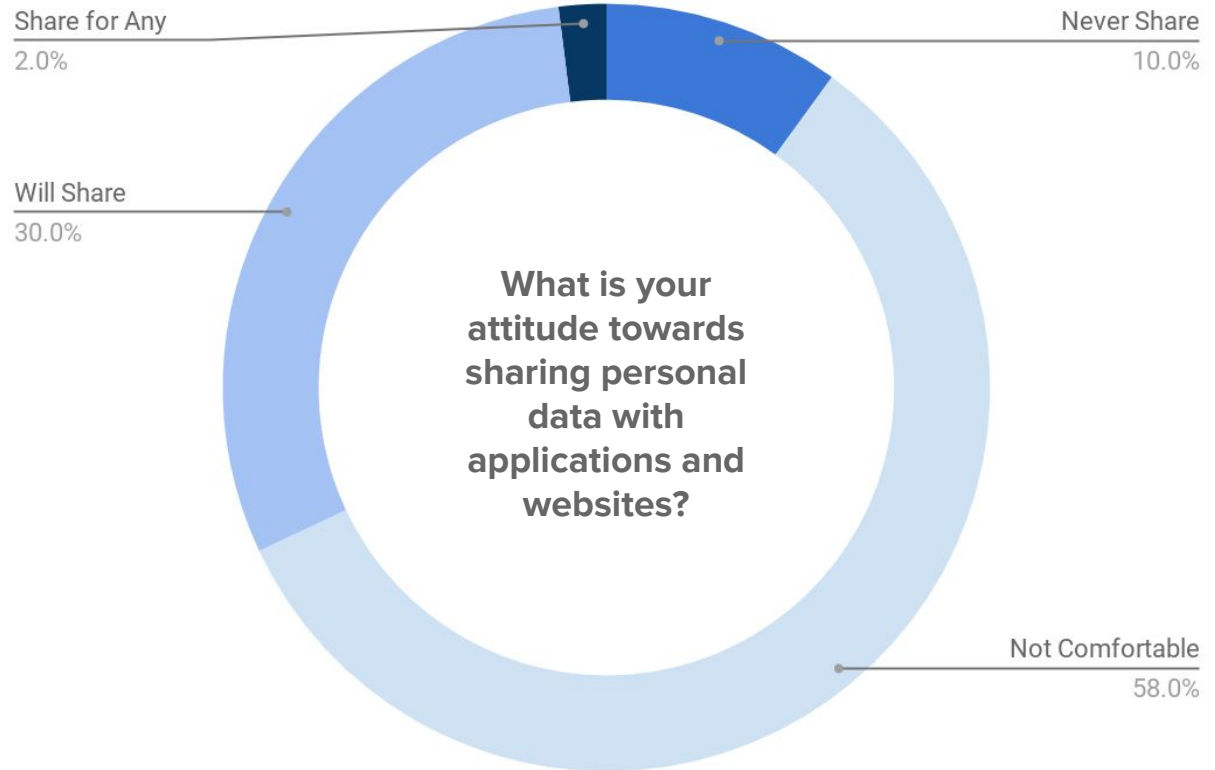
# Data Privacy + Ethics

# Majority are actively concerned about data privacy



## Data Privacy + Ethics

**Majority would share data to get something they want, regardless of comfort level**



**Big Data + Machine Learning are the new Frontier. We are pioneers making up rules as we go.**

## Acknowledgements



### Introduction to Anticipatory Design eBook



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**Senior Drupal Developer**

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<https://www.joelvanbodegraven.nl/>

## DrupalCon Housekeeping

**Locate this session at the DrupalCon Seattle website**  
<https://events.drupal.org/seattle2019/sessions/whats-dinner-using-predictive-ux-help-users-decide>

**Take the DrupalCon survey**  
<https://www.surveymonkey.com/r/DrupalConSeattle>

## Appendix

### Development Tools

- Apache PredictionIO: <https://predictionio.apache.org>
- PredictionIO engine template gallery: <https://predictionio.apache.org/gallery/template-gallery>
- Creating custom Drupal modules: <https://www.drupal.org/docs/8/creating-custom-modules>
- REST API documentation: <https://restfulapi.net>

### References

- [Anticipatory Design](#)
- <https://www.nngroup.com/articles/customization-personalization/>
- [PUX Data Privacy Results](#)
- [Why Scientists Are Upset About The Facebook Filter Bubble Study](#) (link to research study done by Facebook in article)

## Appendix

### Interesting Reads

- “Instagram has a drug problem. Its algorithms are making it worse.”  
[https://www.washingtonpost.com/business/economy/instagram-has-a-drug-problem-its-algorithms-make-it-worse/2018/09/25/c45bf730-bdbf-11e8-b7d2-0773aa1e33da\\_story.html](https://www.washingtonpost.com/business/economy/instagram-has-a-drug-problem-its-algorithms-make-it-worse/2018/09/25/c45bf730-bdbf-11e8-b7d2-0773aa1e33da_story.html)
- “Why artificial intelligence is learning emotional intelligence”  
<https://www.weforum.org/agenda/2018/09/why-artificial-intelligence-is-learning-emotional-intelligence>
- [Measuring the Filter Bubble: How Google is Influencing What You Click](#)



## Appendix

### Interesting Reads

- “Building Ethically Aligned AI”  
<https://www.ibm.com/blogs/research/2019/01/ethically-aligned-ai>
- “Why Amazon’s Anticipatory Shipping Is Pure Genius”  
<https://www.forbes.com/sites/onmarketing/2014/01/28/why-amazons-anticipatory-shipping-is-pure-genius/#3987b2d54605>
- “How Does Spotify Know You So Well?”  
<https://medium.com/s/story/spotify-discover-weekly-how-machine-learning-finds-your-new-music-19a41ab76efe>