Designing Great ML Experiences

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Move your head slowly to complete the circle.
Search

Moments
- Memorial Day
- One Year Ago
- Spring

People
- Barry
- Samantha
- Natalie

Places

Photos | For You | Albums | Search
Design more than just the interface
Dog
Dog
Dog
Dog
Data determines the behavior of the model
Data needs to be designed
Collect data intentionally
Don’t just reflect the world
Data Needs to Be Designed
Data Needs to Be Designed

Collect data intentionally
Data Needs to Be Designed

Collect data intentionally
Test for biases
Data Needs to Be Designed

- Collect data intentionally
- Test for biases
- Update data as products change
Data Needs to Be Designed

Collect data intentionally
Test for biases
Update data as products change
Beware of standard datasets
75%

Accuracy
Metrics are how we define if an experience is good.
Metrics reflect values
Move your head slowly to complete the circle.
Secure
Private
Adaptive
Fast
Accessible
Intuitive
1 in 1,000,000

Face ID
Not all mistakes are equal
Metrics are proxies for what we actually care about
For You
Based on apps you've downloaded.

Very Little Nightmares
Escape room & puzzle adventure
$6.99

Solar Explorer: New Dawn
The ultimate action lander sim
$2.99

Nom Plant
Grow Up!
GET In-App Purchases

Toy Story Drop!
You've got a friend in match3!
GET In-App Purchases

KIDS
A game of crowds.
$2.99
For You
Based on apps you've downloaded.

- **Very Little Nightmares**
  Escape room & puzzle adventure
  $6.99

- **Solar Explorer: New Dawn**
  The ultimate action lander sim
  $2.99

- **Nom Plant**
  Grow Up!
  GET
  In-App Purchase

- **Toy Story Drop!**
  You've got a friend in match3!
  GET
  In-App Purchase

KIDS
A game of crowds.

**Learn to Code at Any Age**

You don't need to be a computer guru to build an app or website. Whether you're after video lessons for your kids or immersive coding adventures just for you, these handpicked tools will get you started.

Coding for young children
It's never too early to begin learning. Start little ones with this selection of...
What we care about evolves
Metrics Reflect Values
Metrics Reflect Values

Understand mistakes
Metrics Reflect Values

Understand mistakes

Design failure scenarios
Metrics Reflect Values

Understand mistakes
Design failure scenarios
Evaluate the experience
Metrics Reflect Values

Understand mistakes
Design failure scenarios
Evaluate the experience
Evolve your metrics
Outputs

- Multiple Options
- Attributions
- Confidence
- Limitations
Outputs

Multiple Options

Attributions
Confidence
Limitations
Outputs

Multiple Options
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Limitations
Outputs

Multiple Options

Attributions

Confidence

Limitations
Outputs

Multiple Options

Attributions
Confidence
Limitations
Multiple Options

Multiple options allow people to choose from among the results a feature generates.
Multiple Options

Prefer diverse options
Multiple Options

Prefer diverse options

Differentiate between options
My Home
Arrived
Home

15 Events
Your first one's at 8:30.
Multiple Options

Prefer diverse options

Differentiate between options

Learn from selection to improve ranking
Outputs

- Multiple Options
- Attributions
- Confidence
- Limitations
Attributions

Attributions are explanations that help people understand more about how your app makes decisions.
Apps

- The Great Courses Plus
- 30 Day Fitness Challenge

Top Picks For You

- micro by THIX (bacteria, fungi and viruses) $1.99
- Magpie - Photos & Notes (Never forget things you love)
- MathTango (Math made fun!)

Learn to Code

- SoloLearn: Learn to Code (Learn to code on the go)
Top Picks For You
Recommendations based on apps you’ve downloaded.

- micro by THIX: $1.99, bacteria, fungi and viruses
- Magpie - Photos & Notes: Never forget things you love
- MathTango: Math made fun!

Learn to Code
SoloLearn: Learn to Code
Learn to code on the go!
Top Picks For You
Because you're into cooking

Kitchen Stories Recipes
Thousands of dishes to enjoy

Tasty
Food videos and recipes

Food Network In the Kitchen
70k+ recipes & fun food vid...

Road Trip Essentials

Weather Underground
Hyper-Local Forecast
Top Picks For You
Because you're into cooking

Kitchen Stories
Recipes
Thousands of dishes to enjoy

Tasty
Food videos and recipes

Food Network In the Kitchen
70k+ recipes & fun food vid...

Road Trip Essentials

Weather Underground
Hyper-Local Forecast
Top Picks For You
Because you love NYT Cooking

- Kitchen Stories Recipes
  Thousands of dishes to enjoy

- Tasty
  Food videos and recipes

- Food Network In the Kitchen
  70k+ recipes & fun food vid...

Road Trip Essentials
See All

- Weather Underground
  Hyper-Local Forecast
Top Picks For You
Because you've downloaded NYT Cooking

Kitchen Stories
Recipes
Thousands of dishes to enjoy

Tasty
Food videos and recipes

Food Network In the Kitchen
70k+ recipes & fun food vid...

Road Trip Essentials
Weather Underground
Hyper-Local Forecast
Attributions

Avoid profiling people

Relate to objective facts, not subjective taste
What can I help you with?
What can I help you with?
Jupiter will rise at 8:40 P.M. EDT on Tuesday, June 4, 2019.

Input interpretation
Jupiter  next rise

Result
8:40 pm EDT  |  Tuesday, June 4, 2019

Time difference from now (1:04:10 P.M.)
7 hours  35 minutes  49 seconds in the future

Time until midnight (EDT)
3 hours  20 minutes

Sky position from New York City, New York at 8:...
(not currently visible)

altitude  -38.39.45° (below horizon)
Jupiter will rise at 8:40 P.M. EDT on Tuesday, June 4, 2019.

Input interpretation
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Result
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Sky position from New York City, New York at 8:40 P.M. EDT
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altitude: -38.3945° (below horizon)
Attributions

Avoid profiling people

Relate to objective facts, not subjective taste

Cite data sources
Top Picks For You
85% Match

micro by THIX
bacteria, fungi and viruses
$1.99

Magpie - Photos & Notes
Never forget things you love

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Math made fun!

Learn to Code

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Learn to code on the go!
Top Picks For You
Recommendations based on apps you've downloaded.

micro by THIX
bacteria, fungi and viruses
$1.99

Magpie - Photos & Notes
Never forget things you love

MathTango
Math made fun!

Learn to Code
SoloLearn: Learn to Code
Learn to code on the go!
Confidence

Confidence is a measurement of certainty for a result.
<table>
<thead>
<tr>
<th>Day</th>
<th>Weather</th>
<th>High</th>
<th>Low</th>
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</thead>
<tbody>
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<td>63°</td>
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<tr>
<td>3PM</td>
<td>63°</td>
<td>61°</td>
<td>60°</td>
</tr>
<tr>
<td>Wednesday</td>
<td></td>
<td>65</td>
<td>52</td>
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<td>Thursday</td>
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<td>Monday</td>
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<td>72</td>
<td>52</td>
</tr>
<tr>
<td>Tuesday</td>
<td></td>
<td>67</td>
<td>49</td>
</tr>
</tbody>
</table>
Confidence

Numbers are appropriate for statistical predictions
Current Lowest Price:
$990 / traveler

You should wait for a better price, but book before July 21.
You could save as much as $280 per ticket by watching this trip.

Watch This Trip

View Flights

Nonstop cost $344 more.

Choose Nonstop

Price Prediction
Current Lowest Price: $990/traveler

You should wait for a better price, but book before July 21.
You could save as much as $280 per ticket by watching this trip.

Watch This Trip

View Flights

Nonstops cost $344 more.
Choose Nonstop

Price Prediction

Watch Notifications Search Trips
Current Lowest Price: $990/traveler

You should wait for a better price, but book before July 21.
You could save as much as $280 per ticket by watching this trip.

Watch This Trip

View Flights

Nonstop cost $344 more.

Choose Nonstop

Price Prediction
SFO – PAR
Jul 24 – Jul 30

Current Lowest Price: $990/traveler

You should wait for a better price, but book before July 21.
You could save as much as $280 per ticket by watching this trip.

Watch This Trip

View Flights

Nonstops cost $344 more.

Choose Nonstop

Price Prediction
Confidence

Numbers are appropriate for statistical predictions

Translate confidence into easy to understand terms
Confidence

Numbers are appropriate for statistical predictions
Translate confidence into easy to understand terms
Use range to help people understand risk
There are additional photos for review.
There are additional photos for review.
Outputs

Multiple Options

Attributions

Confidence

Limitations
Limitations

Limitations happen when there’s a mismatch between people’s mental model of the feature and what the feature can actually do.
Limitations

Manage expectations
Limitations

Manage expectations

Guide people to move past limitations
Limitations

Manage expectations

Guide people to move past limitations

Suggest alternatives
Outputs are a design medium
Outputs

- Multiple Options
- Attributions
- Confidence
- Limitations
Model

- Data
- Metrics

Interface

Outputs
- Multiple Options
- Attributions
- Confidence
- Limitations

Inputs
- Calibration
- Implicit Feedback
- Explicit Feedback
- Corrections

User
Inputs

- Calibration
- Implicit Feedback
- Explicit Feedback
- Corrections
Inputs

Calibration

Implicit Feedback

Explicit Feedback

Corrections
Inputs

Calibration

 Implicit Feedback

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Inputs

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Explicit Feedback

Corrections
Inputs

Calibration
Implicit Feedback
Explicit Feedback
Corrections
Inputs
- Calibration
- Implicit Feedback
- Explicit Feedback
- Corrections
Calibration

Calibration allows people to provide essential information needed to engage in an experience.
View should cover player and hoop.
View should cover player and hoop.
Move your head slowly to complete the circle.
Calibration
Calibration

Be quick and effortless
Calibration

Be quick and effortless

Avoid the need for multiple calibrations
Face ID

iPhone can recognize the unique, three-dimensional features of your face to unlock automatically, use Apple Pay, and make purchases from the iTunes and App Stores.

About Face ID & Privacy...

Continue

Set Up Later in Settings
Move your head slowly to complete the circle.

Accessibility Options
Move your head slowly to complete the circle.
Move your head slowly to complete the circle.
Move your head slowly to complete the circle.
Face ID is now set up.
Calibration

Be quick and effortless

Avoid the need for multiple calibrations
Calibration

Be quick and effortless

Avoid the need for multiple calibrations

Introduce, guide and confirm
Calibration

Be quick and effortless

Avoid the need for multiple calibrations

Introduce, guide and confirm
Calibration

Be quick and effortless

Avoid the need for multiple calibrations

Introduce, guide and confirm

Allow people to update information
Move your head slowly to complete the circle.
Inputs

Calibration

Implicit Feedback

Explicit Feedback

Corrections
Inputs

- Calibration
- Implicit Feedback
- Explicit Feedback
- Corrections
Implicit Feedback

Implicit feedback is information that arises from the interactions people have with your app.
Implicit Feedback
Implicit Feedback

Strive to identify people’s intention
Implicit Feedback

Strive to identify people’s intention
Implicit Feedback

Strive to identify people’s intention

Accuracy over speed
IN "CALENDAR"

Show Siri Suggestions in App
Learn from this App

Allow Siri to make suggestions in "Calendar" and learn from how you use "Calendar" to make suggestions across apps.

IN SEARCH

Show in Search
Suggest Shortcuts

Allow Search and Look Up to show information or shortcut suggestions for "Calendar". Shortcut suggestions are based on how you use "Calendar".
Show Siri Suggestions in App

Learn from this App

Allow Siri to make suggestions in "Calendar" and learn from how you use "Calendar" to make suggestions across apps.

Show in Search

Suggest Shortcuts

Allow Search and Look Up to show information or shortcut suggestions for "Calendar". Shortcut suggestions are based on how you use "Calendar".
Implicit Feedback

Strive to identify people’s intention

Accuracy over speed
Implicit Feedback

Strive to identify people’s intention

Accuracy over speed

Respect people’s privacy
Implicit Feedback

Strive to identify people’s intention
Accuracy over speed
Respect people’s privacy
Implicit Feedback

Strive to identify people’s intention

Accuracy over speed

Respect people’s privacy

Make interactions more accurate and delightful
Inputs

- Calibration
- Implicit Feedback
- Explicit Feedback
- Corrections
Inputs

Calibration

Implicit Feedback

Explicit Feedback

Corrections
Explicit Feedback

Explicit Feedback allows your app to collect information by asking specific questions regarding your results.
Love

Dislike
Explicit Feedback

Prioritize negative feedback over positive
Explicit Feedback

Prioritize negative feedback over positive
Explicit Feedback

Prioritize negative feedback over positive

Clearly describe each option and its consequences
Explicit Feedback

Prioritize negative feedback over positive

Clearly describe each option and its consequences
Explicit Feedback

Prioritize negative feedback over positive

Clearly describe each option and its consequences

Act immediately and persistently
Angie
Yes absolutely! Muir Woods is on! Let’s meet at 8am at my place!

Sounds good! Are you bringing **angie**?
Don't Correct "Angie"

Don't Correct to "angle"
Yes absolutely! Muir Woods is on! Let’s meet at 8am at my place!

Sounds good! Are you bringing angle with you?
Yes absolutely! Muir Woods is on! Let’s meet at 8am at my place!

Sounds good! Are you bringing Angie with you?
Sounds good! Are you bringing Angie with you?

Yes of course! She wouldn’t want to miss it!

Woohoo! Can’t wait to see Angie
Inputs

Calibration

Implicit Feedback

Explicit Feedback

Corrections
Inputs

Calibration
Implicit Feedback
Explicit Feedback
Corrections
Corrections

Corrections allows people to fix a mistake a model has made using known tasks
Sounds good! Are you bringing Angie with you?

Yes of course! She wouldn’t want to miss it!

Woohoo! Can’t wait to see Angie
Corrections

Allow corrections through familiar ways
Corrections

Allow corrections through familiar ways

Provide immediate value
Corrections

Allow corrections through familiar ways

Provide immediate value

Use corrections as implicit feedback
Interface

Outputs
- Multiple Options
- Attributions
- Confidence
- Limitations

Inputs
- Calibration
- Implicit Feedback
- Explicit Feedback
- Corrections
Respect people’s work
Model

Data

Metrics

Interface

Outputs
- Multiple Options
- Attributions
- Confidence
- Limitations

Inputs
- Calibration
- Implicit Feedback
- Explicit Feedback
- Corrections

Attributions

Confidence

Limitations
Attention management
Attention management
Great recommendations
Attention management
Great recommendations
Contextual information
Attention management
Great recommendations
Contextual information
Automate mundane tasks
... and much more.
Be Healthy
Be Inclusive
Be Safe

Hold your finger on the crown.
Be Creative
Elevate the best of humanity
developer.apple.com/design/human-interface-guidelines/machine-learning
<table>
<thead>
<tr>
<th>Lab</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Lab</td>
<td>Friday, 12:00</td>
</tr>
<tr>
<td>Machine Learning Lab</td>
<td>Friday, 2:00</td>
</tr>
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More Information

developer.apple.com/wwdc2019/803
WWDC19