What are the Consequences for the User When It Fails?

Responsible AI: Human-Centered Design

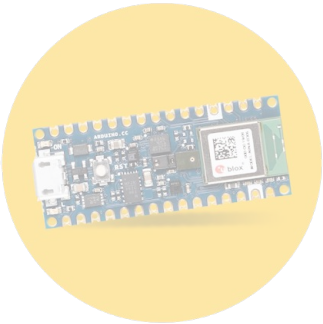
START | **DESIGN** | DEVELOPMENT | DEPLOYMENT | END

Course 1
Fundamentals of TinyML

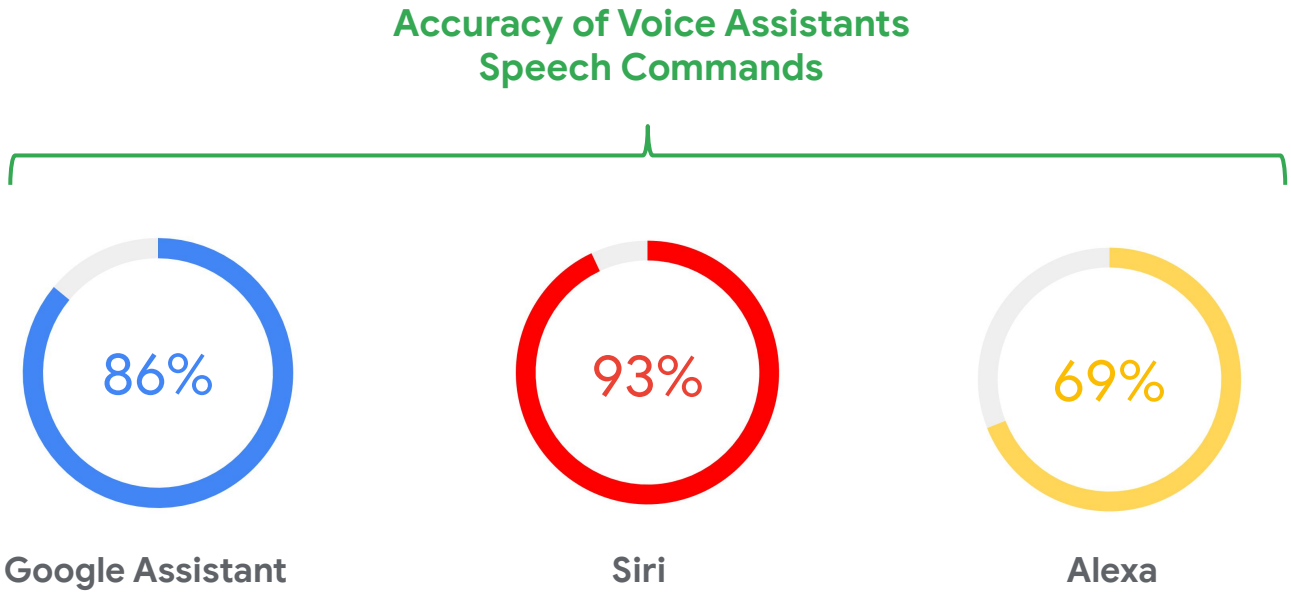
- What am I building?
- Who am I building this for?
- **What are the consequences for the user if it fails?**

Course 2
Applications of TinyML

Course 3
Deploying TinyML



AI isn't perfect



Source: https://loupventures.com/annual-digital-assistant-iq-test/

What are the consequences for the user?

When AI **succeeds**

	Actual Disease = Yes	Actual Disease = No
Predicted Disease = Yes	**True Positive**	False Positive
Predicted Disease = No	False Negative	**True Negative**

When AI **fails**

	Actual Disease = Yes	Actual Disease = No
Predicted Disease = Yes	True Positive	**False Positive**
Predicted Disease = No	**False Negative**	True Negative

Two types of **error**

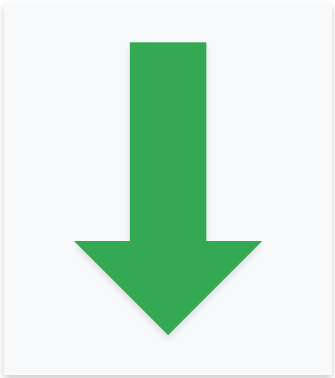
	Actual Disease = Yes	Actual Disease = No
Predicted Disease = Yes	True Positive	False Positive ***Type 1 Error***
Predicted Disease = No	False Negative ***Type 2 Error***	True Negative

2 types of error?

2 ways to **optimize**!

Precision

If we optimize our model for **high precision**

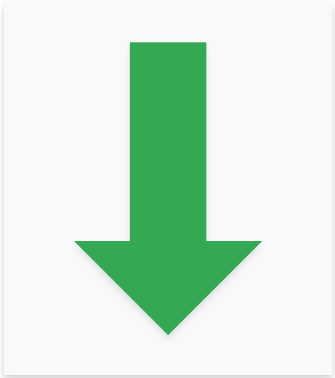


We **minimize** *Type 1* Errors
(fewer false positives)

We **increase** *Type 2* Errors
(more false negatives)

Recall

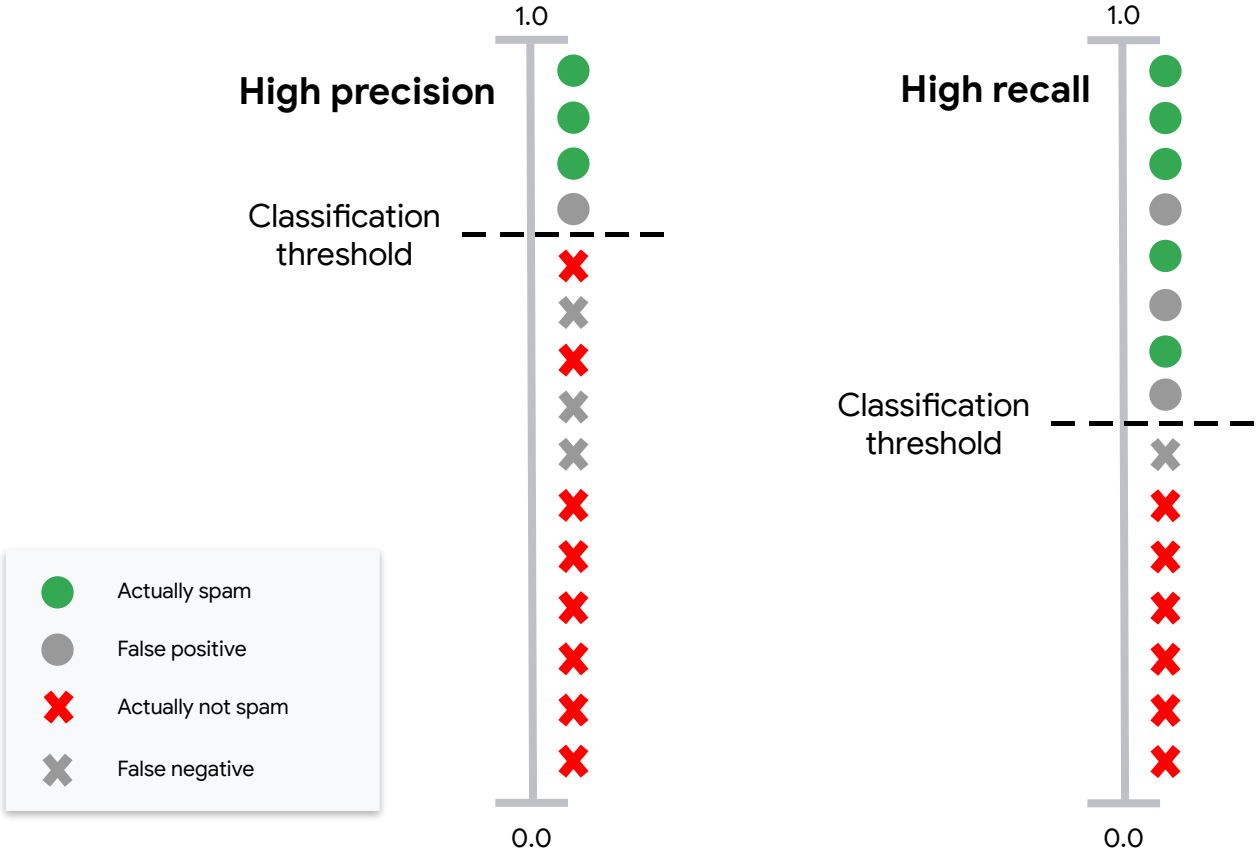
If we optimize our model for **high recall**



We **minimize** *Type 2* Errors
(fewer false negatives)

We **increase** *Type 1* Errors
(more false positives)

Tension between Precision and Recall



Q: Which measure is more important?

A: It depends!

4 Key Questions

1. Who are the key stakeholders (both direct and indirect)?
2. What are the consequences of a ***Type 1*** error?
3. What are the consequences of a ***Type 2*** error?
4. Which type of error would be most harmful?

Which measure is more important?

4 Which type of error would be most harmful?

If ***Type 1*** errors are most harmful,
then **precision** is more important

If ***Type 2*** errors are most harmful,
then **recall** is more important

Spam Filtering

1	Key stakeholders?	user with email account; user's correspondents
2	*Type 1* error?	user doesn't receive important email, correspondent is unable to communicate with user
3	*Type 2* error?	user sees spam in email inbox
4	Most harmful?	***Type 1*** errors most harmful to stakeholders

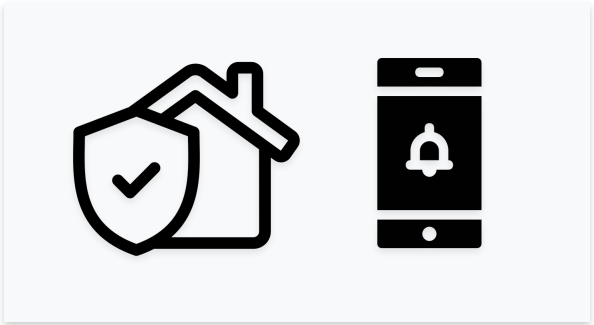
optimize for **higher precision**

Smart Smoke Detector

1	Key stakeholders?	user of device; members of household; neighbors
2	*Type 1* error?	user / members of household annoyed by false alarms
3	*Type 2* error?	user / members of household don't evacuate during fire; neighbors have less time to respond as fire spreads
4	Most harmful?	***Type 2*** **errors most harmful to stakeholders**

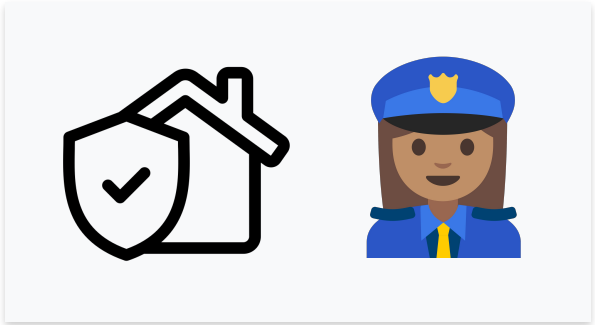
optimize for **higher recall**

Home Surveillance



User Notified

Type 2 error is most harmful
higher recall is preferred



Police Notified

Type 1 error harms indirect stakeholders
slightly higher precision is preferred