Harvard

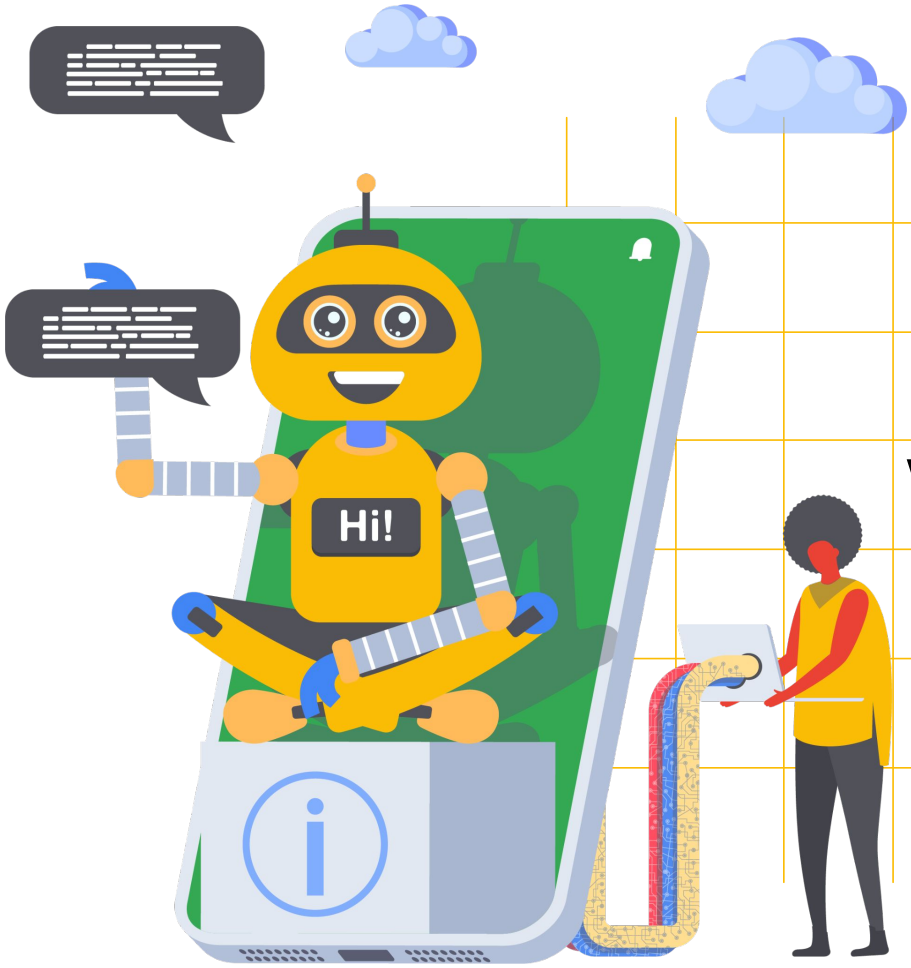
Yá’át’ééh 👋

CRESTLEX 3.0

CReating **E**ffective **ST**em
Learning **EX**periences

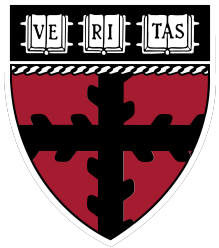
with Navajo Tech

Harvard



Where ML works?

with Dhilan


VE
RI
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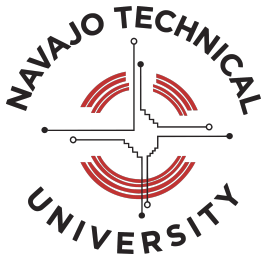
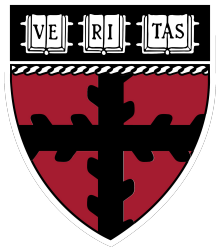
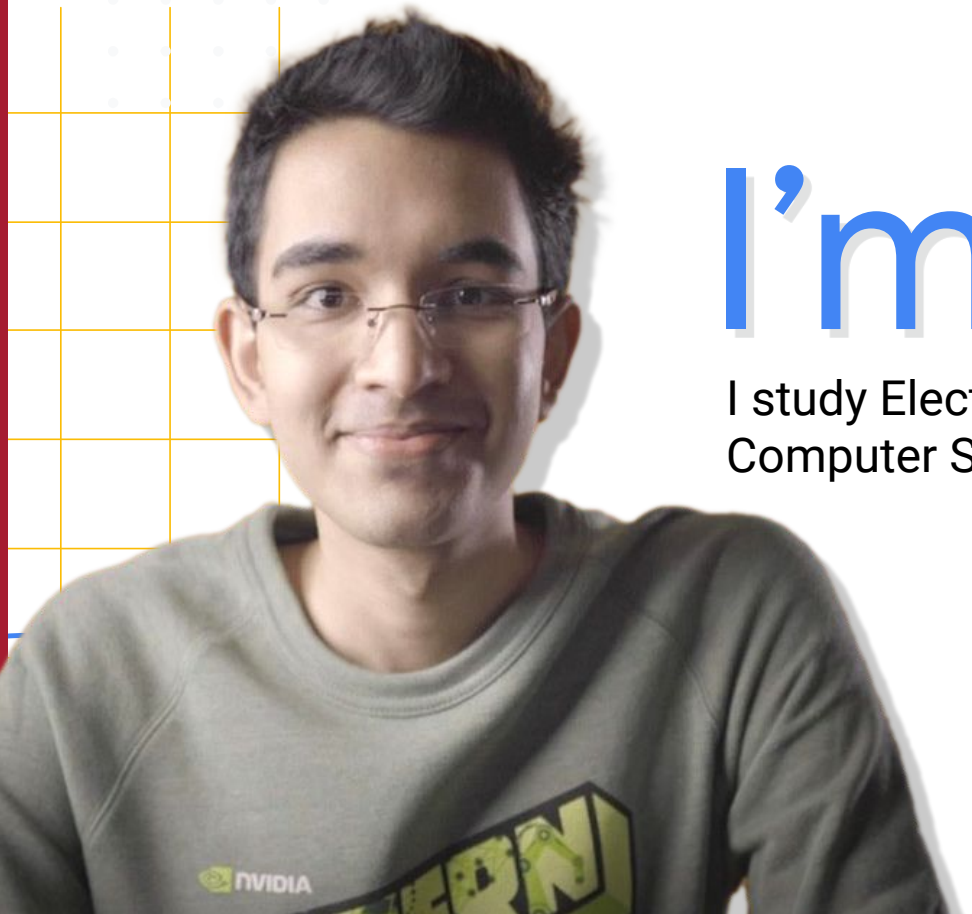

NAVAJO TECHNICAL
UNIVERSITY



VE RI TAS

NAVAJO TECHNICAL
UNIVERSITY

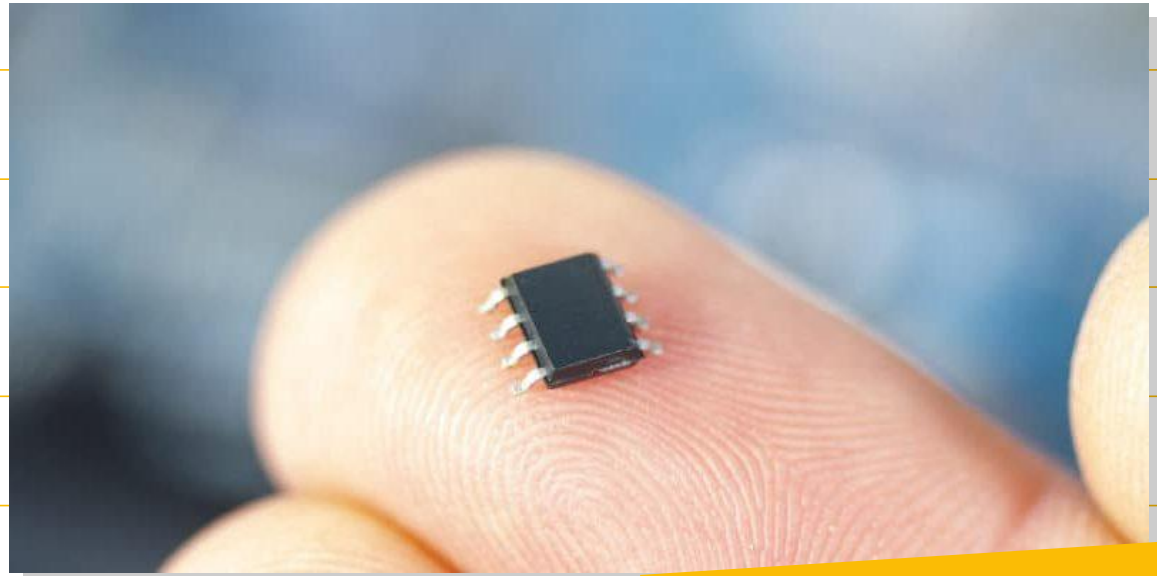


I'm Dhilan!

I study Electrical Engineering and Computer Science at **Harvard**.

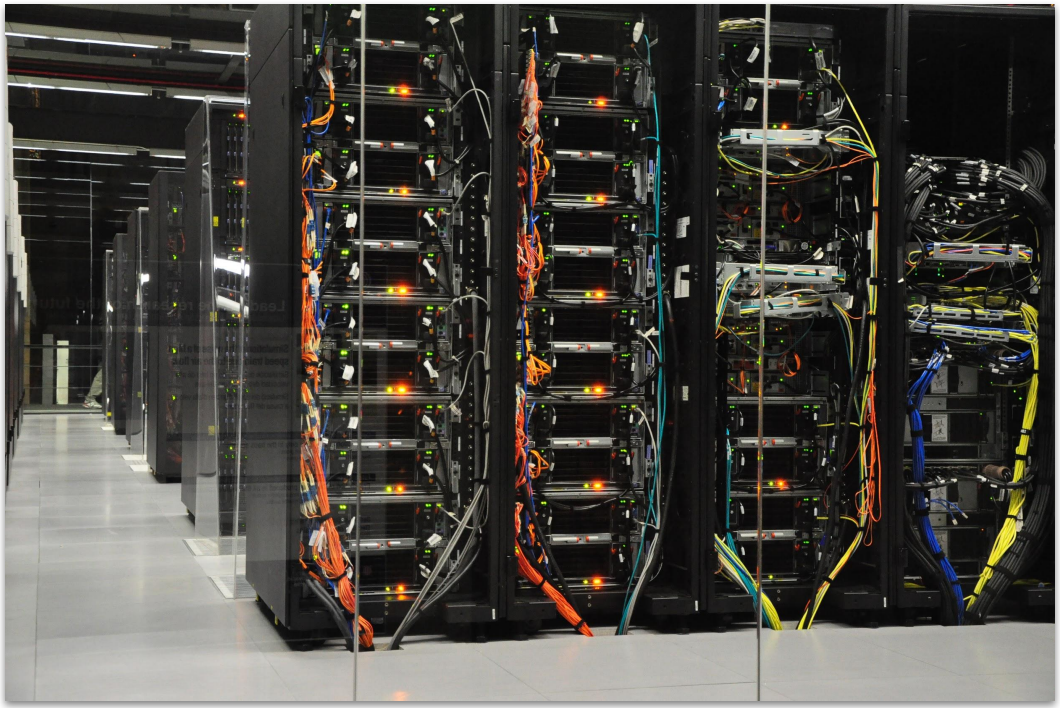
deploy

to your tiny **devices**!

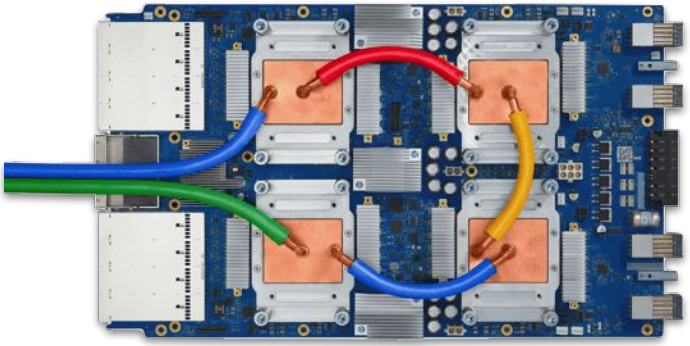


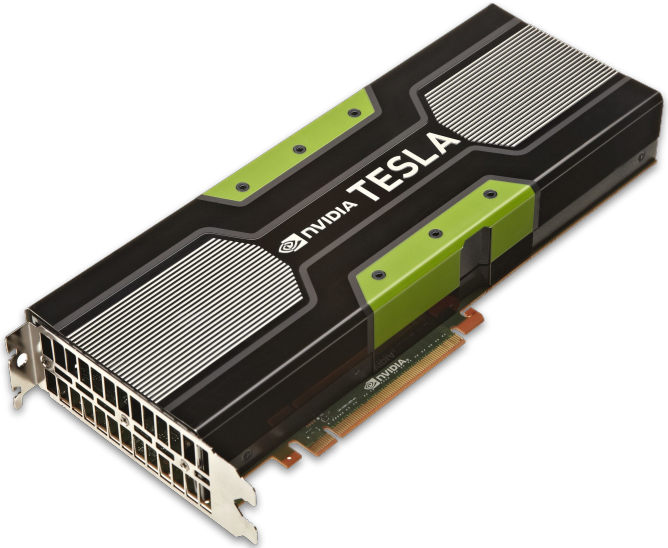
TinyML

Datacenter

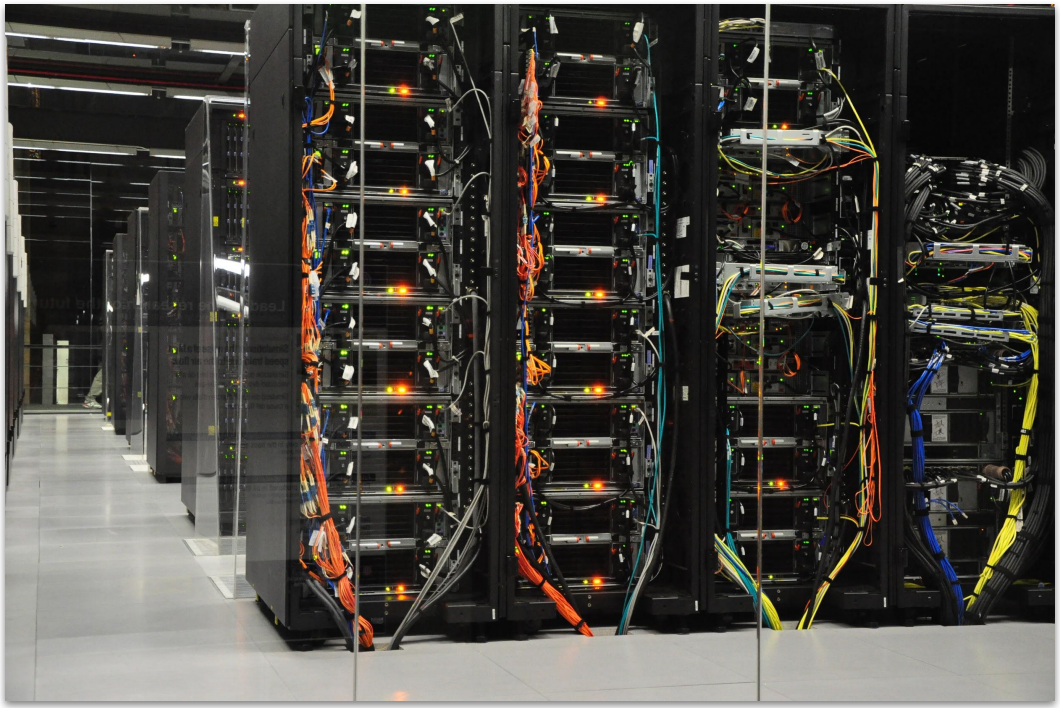


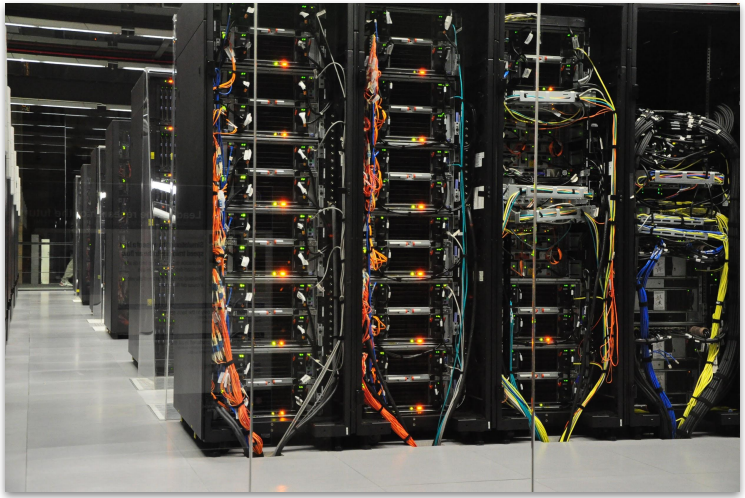
TPUs/GPUs

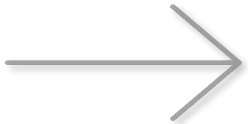




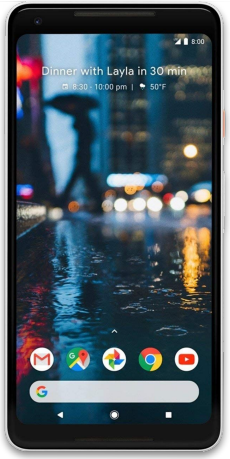
Bigger Is Not Always Better.








8:00
Dinner with Layla in 30 min
8:30 - 10:00 pm | 50°F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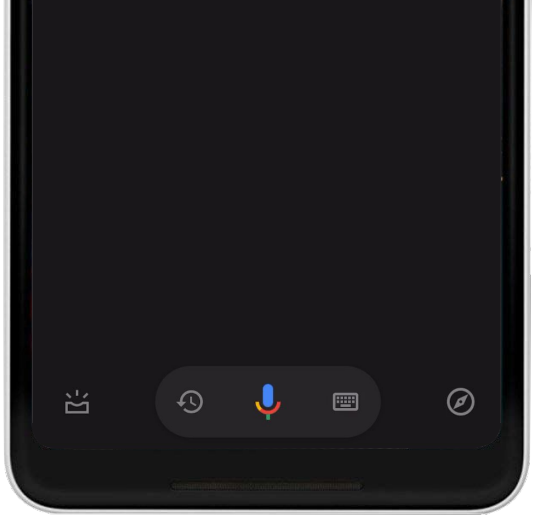

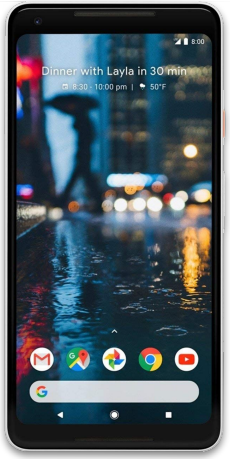
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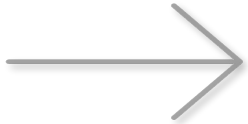
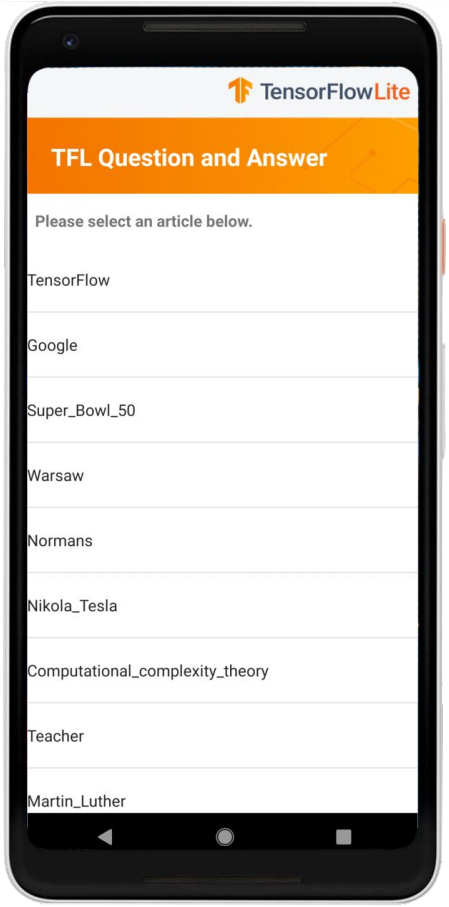
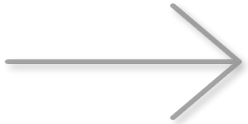
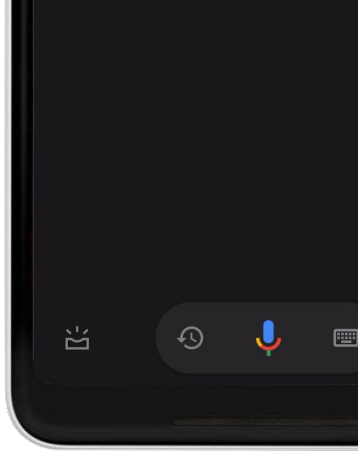
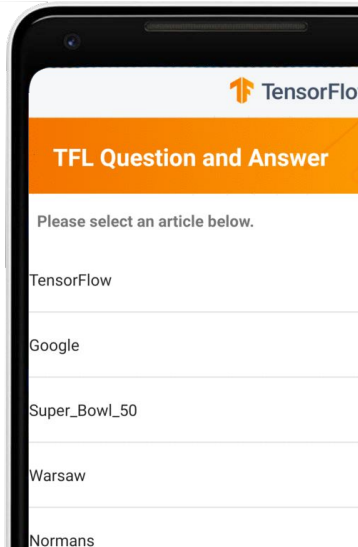
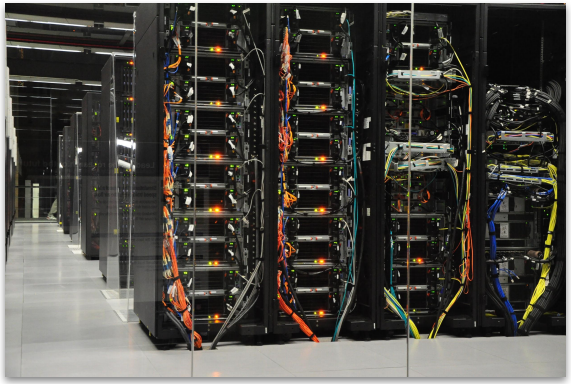



TensorFlowLite
TFL Question and Answer
Please select an article below.
TensorFlow
Google
Super_Bowl_50
Warsaw
Normans
Nikola_Tesla
Computational_complexity_theory
Teacher
Martin_Luther





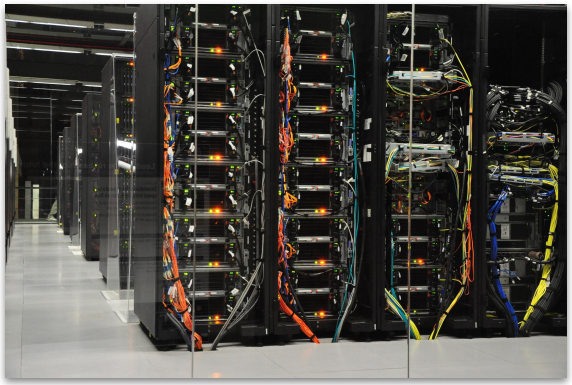

TensorFlo
TFL Question and Answer
Please select an article below.
TensorFlow
Google
Super_Bowl_50
Warsaw
Normans

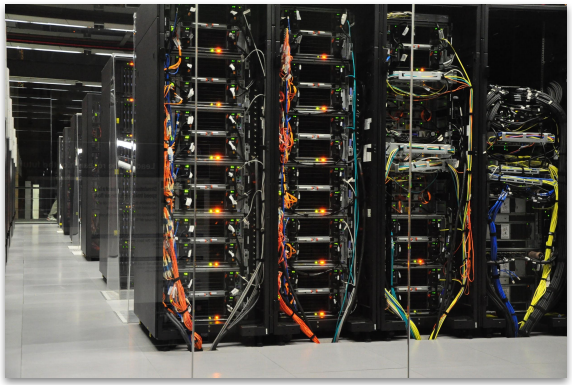


High power
High bandwidth
High latency

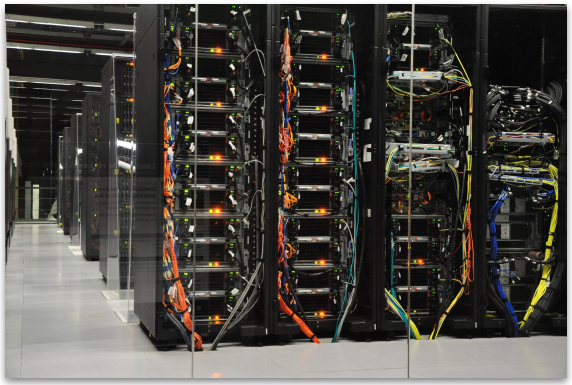
Low power
Low bandwidth
Low latency


Dinner with Layla in 30 min
ALWAYS
ON?






Dinner with Layla in 30 min



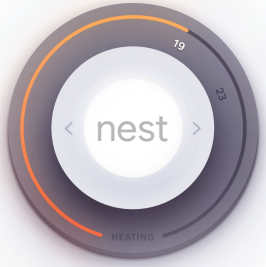
Google Assistant

Endpoint Devices

Google Assistant

Endpoint Devices

Google Assistant



Endpoints Have **Sensors**, Tons of Sensors

Motion Sensors
Gyroscope, radar, magnetometer, accelerator

Acoustic Sensors
Ultrasonic, Microphones, Geophones, Vibrometers

Environmental Sensors
Temperature, Humidity, Pressure, IR, etc.

Touchscreen Sensors
Capacitive, IR

Image Sensors
Thermal, Image

Biometric Sensors
Fingerprint, Heart rate, etc.

Force Sensors
Pressure, Strain

Rotation Sensors
Encoders

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Encoders

Biometric Sensors

Non-invasive Glucose Monitoring

Fingerprint + Photoplethysmography (**PPG**)

Source: Jacobs School of Engineering/UC San Diego

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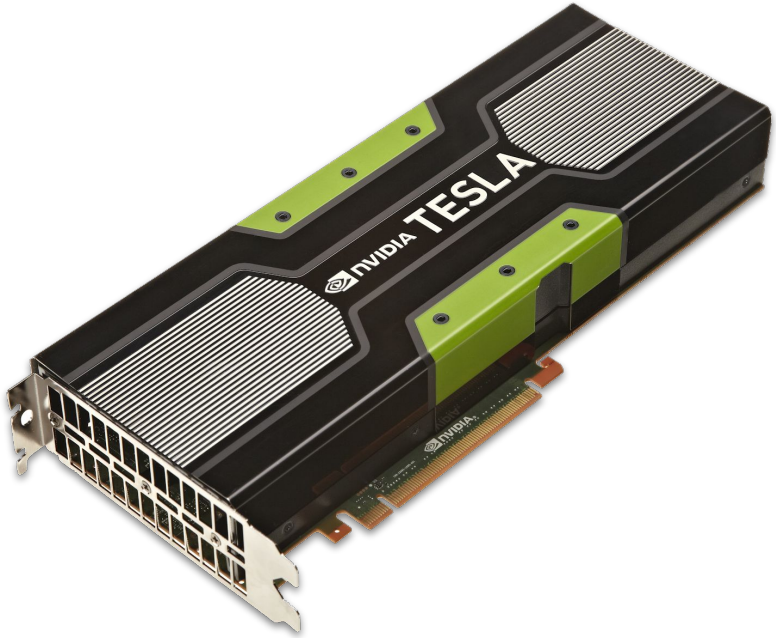
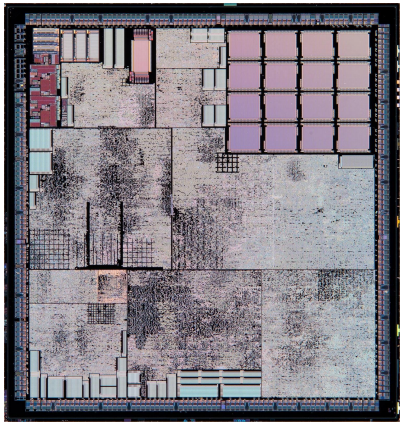
Thinking **Big**



Thinking **Big**



Thinking **Big**

Thinking **Small**

BIG

GPU / CPU

561mm²

Thinking **Small**

BIG

GPU / CPU

561mm²

Thinking **Small**

Thinking **Tiny**

BIG
GPU / CPU
561mm²

SMALL
Mobile SoC
83mm²

Thinking **Tiny**

BIG
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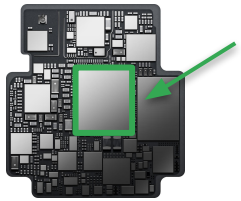


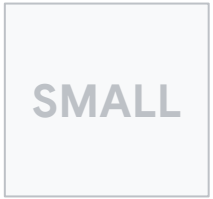
Thinking **Tiny**

Mobile SoC
83mm²

Apple 0778
30mm²

We’re just getting started.

Thinking **Record-breaking**

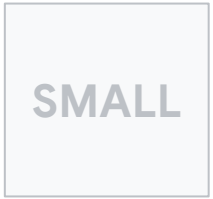


Mobile SoC
83mm²

Apple 0778
30mm²

Kinetis KL03
3.2mm²

Thinking **Record-breaking**



Mobile SoC
83mm²

Apple 0778
30mm²

world's smallest ARM-Powered MCU

48MHz, 32KB flash, 20-pin

Kinetis KL03
3.2mm²


2.0 mm
1.6 mm

250 Billion

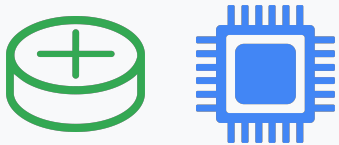
MCUs today

Challenges

Latency & Bandwidth

Accuracy & Personalization

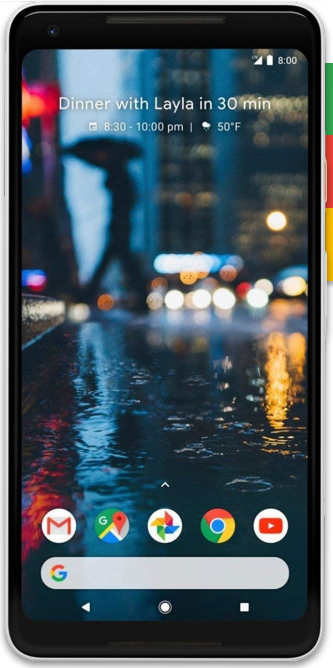
Security & Privacy



Battery & Memory

Source: Google

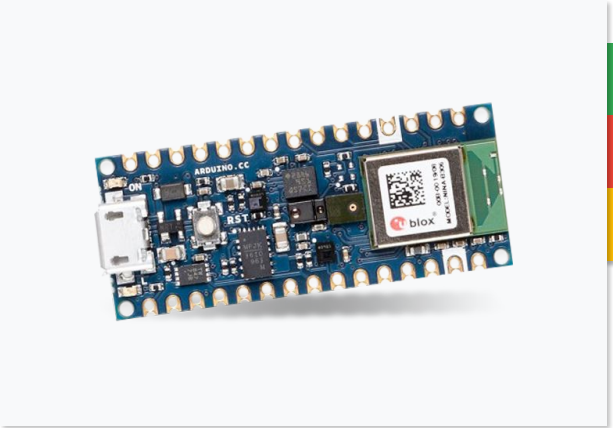
Source: Google



Less memory

Less compute power

Only focused on *inference*



Even less memory

Even less compute power

Also, only focused on *inference*

Workshop **Agenda**

Morning Session (**9–11am**)

- **The Future of AI** (with Laurence)
- **How ML Works?** (with Dhilan)
- **ML in the Navajo Nation** (with Peter)
- **Responsible AI** (with Susan)

Afternoon Session (**12pm–2pm**)

- **Experimenting with AI** (with Dhilan)
- **Exploring ML** (with Jenny)
- **Build it! Your own app** (with Jenny)
- **What's Next?** (with guest student panel)
- **What's Next?** (with instructors)

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Looking forward to **tomorrow**

1. Brainstorm ways to **use ML in your communities** (in the Navajo Nation)

Looking forward to **tomorrow**

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2. Explore the challenges of deploying machine learning to **tiny** devices.

Looking forward to **tomorrow**

1. Brainstorm ways to **use ML in your communities** (in the Navajo Nation)
2. Explore the challenges of deploying machine learning to **tiny** devices.
3. Think about what's **missing** from datasets.

Looking forward to **tomorrow**

1. Brainstorm ways to **use ML in your communities** (in the Navajo Nation)
2. Explore the challenges of deploying machine learning to **tiny** devices.
3. Think about what's **missing** from datasets.
4. **Train** and **deploy** your own ML models!


hágoónee’ 👋

see you **tomorrow**!