

tinyML[®] Summit

Miniature dreams can come true...

March 28-30, 2022 | San Francisco Bay Area



www.tinyML.org

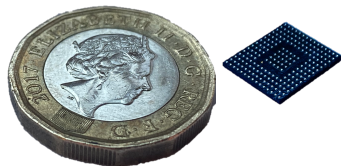
Tiny models with big appetites: Cultivating the perfect data diet



Plumerai people detection

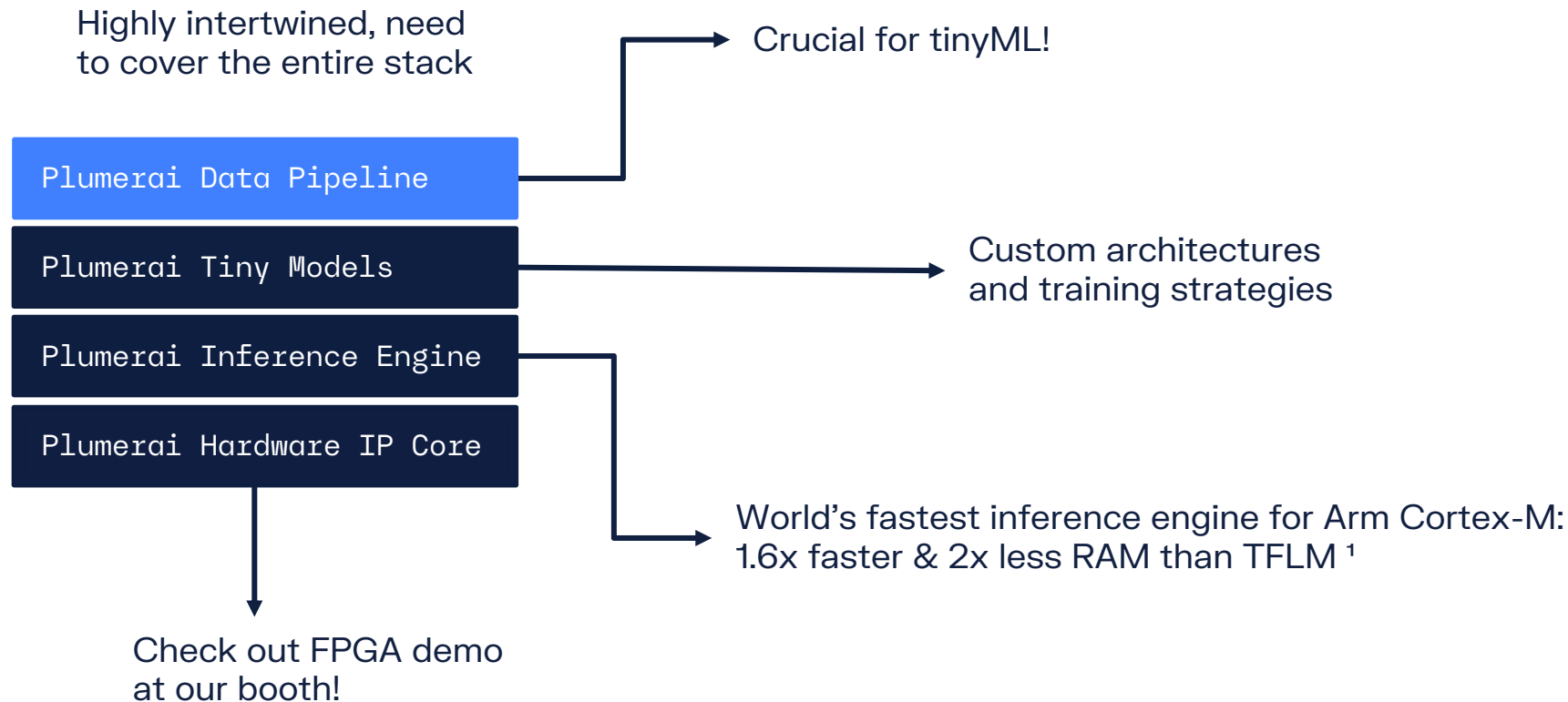


Production-worthy computer vision on Arm Cortex-A
SoCs and even \$1 Cortex-M microcontrollers.



Come check these
demos live at our booth!

How did we do it?



1. <https://blog.plumerai.com/2021/10/cortex-m-inference-software/>

Why not just use public data?

Irrelevant context



Bias: must be worth looking at



We need to design a good dataset before we can design a good model!



No pe

Shortcut: blue background, no people!



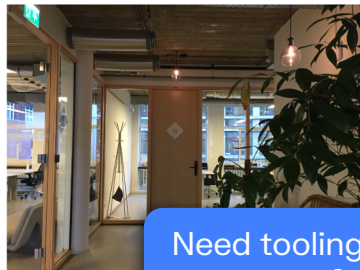
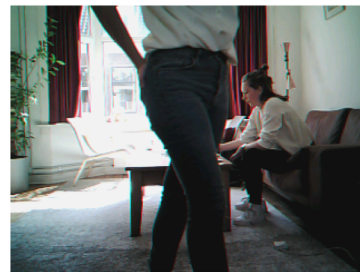
People

Person-centered!



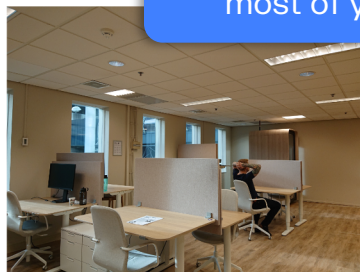
Plumerai dataset

Not person-centered



Need tooling to make the most of your data!

Nothing to look at...



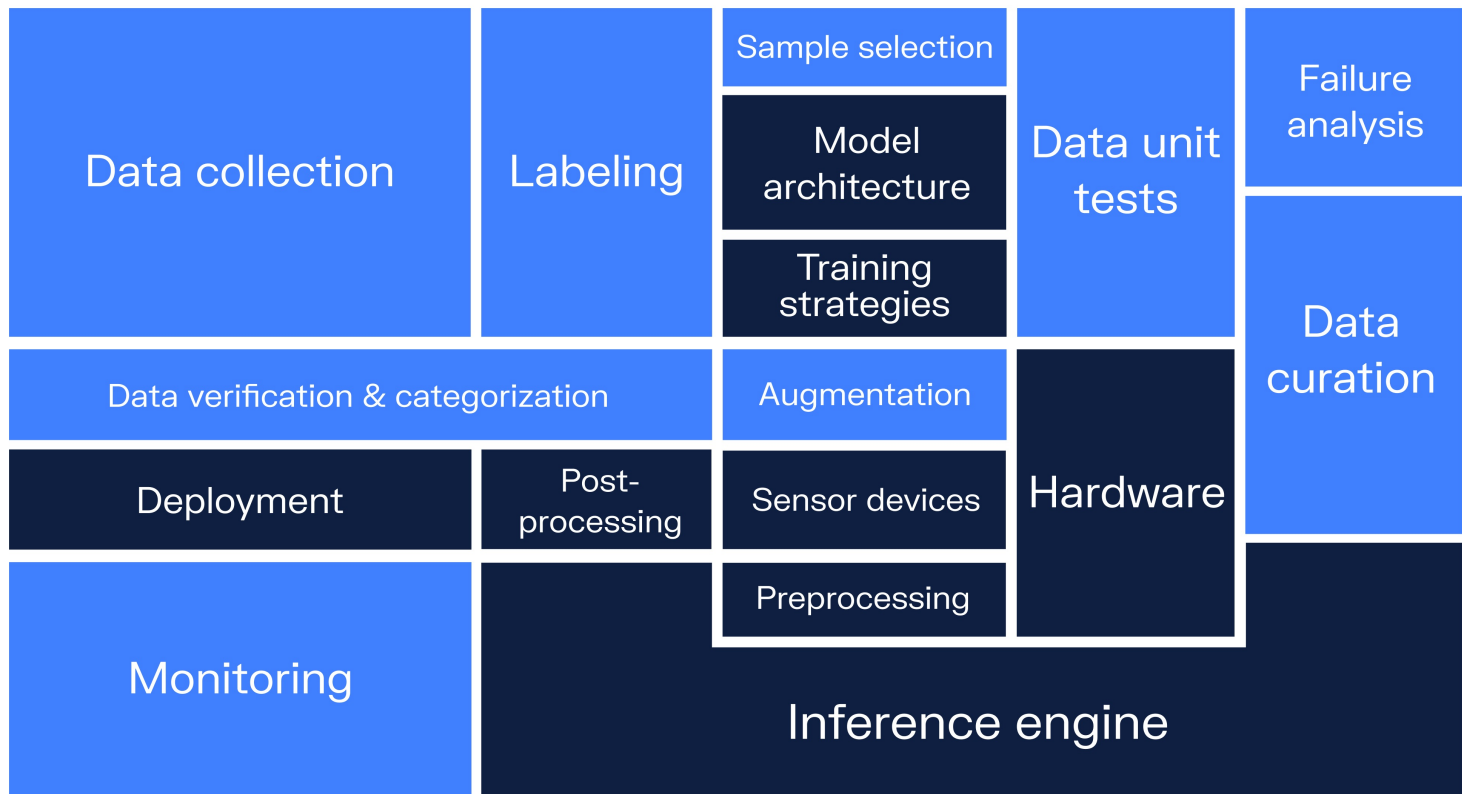
Plumerai infrastructure

Infrastructure overview

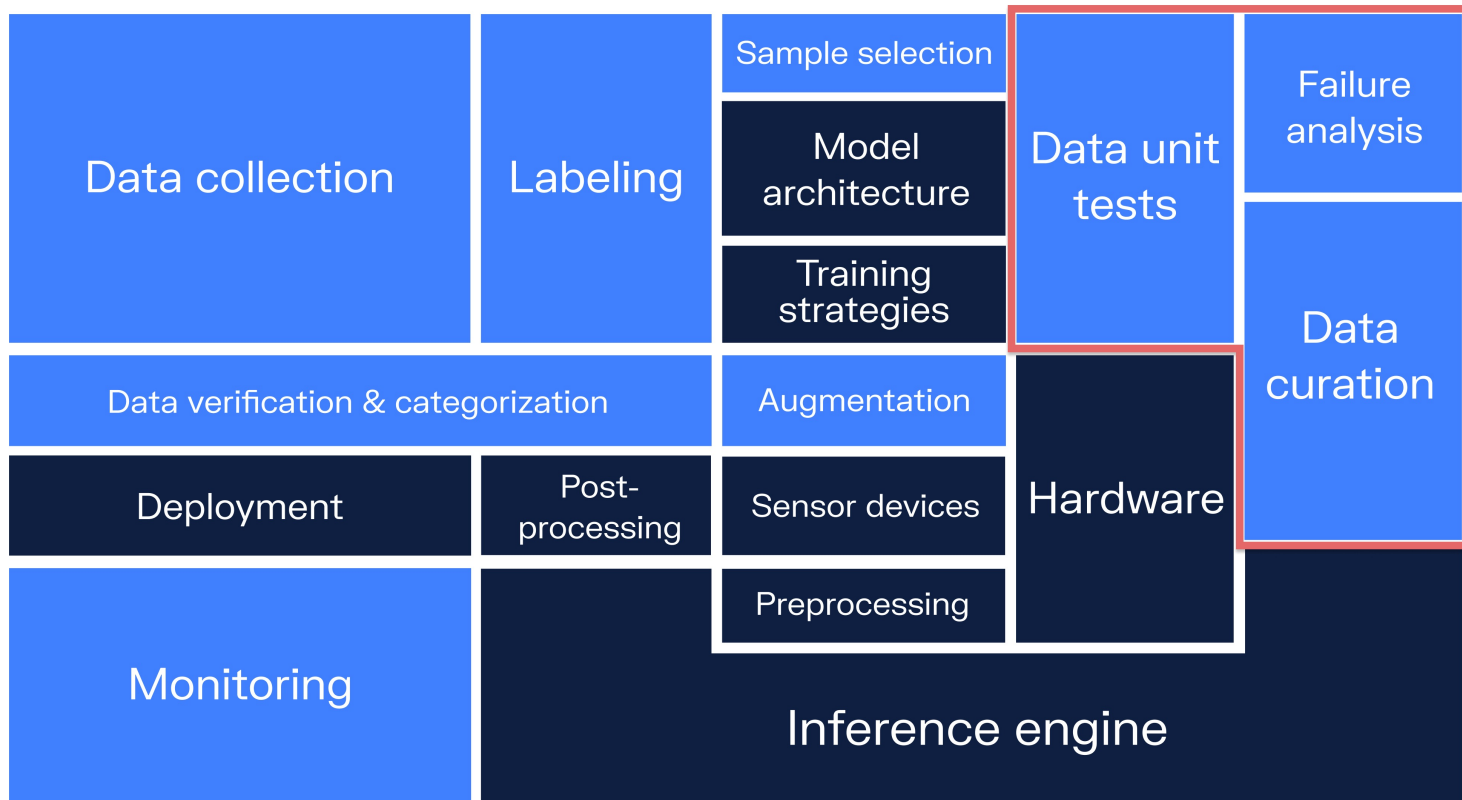
Model
architecture

Training
strategies

Infrastructure overview



Infrastructure overview



Data unit tests

Cannot capture model behavior in a single metric!

Unit Tests Passed: 73 / 84

- ✓ empty_desk
- ✓ empty_hallway
- ✓ empty_office
- ✓ person_desk_face
- ✓ person_desk_back
- ✓ person_
- ✓ person_
- ✓ person_hallway_within_4m
- ✓ person_hallway_4_7m
- ✗ person_hallway_beyond_7m
- ✓ skin_tone_1
- ✓ skin_tone_2
- ✓ skin_tone_3

Real-life performance

...



Edge cases

Data curation cycle

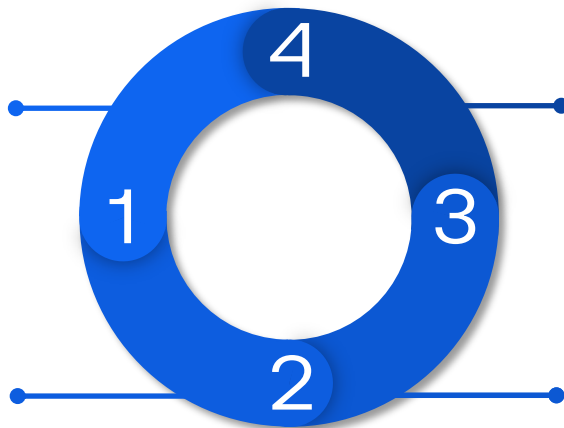
Need **good data tooling** to:

Test-driven development

Identify failure cases

Link problem to training data:

- Visual similarity
- Interactive classification
- Training influence
- ...

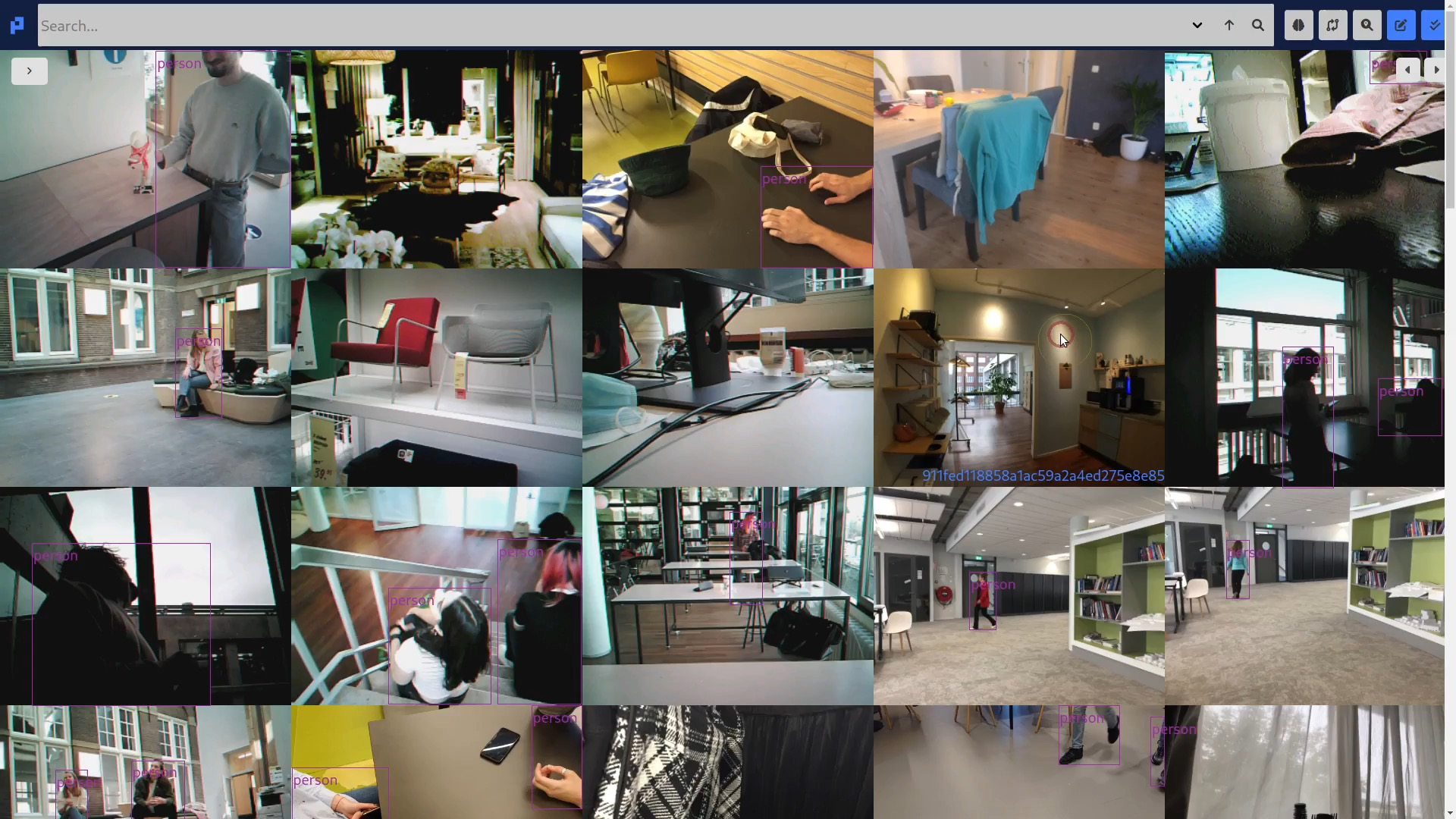


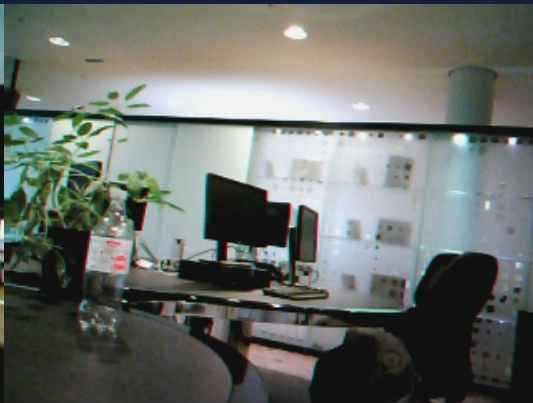
Re-train model

- Correct labels
- Oversampling
- Address problems
- Targeted augmentation
- Supervised Contrastive Learning
- Add / **remove** data
- ...

Quality > quantity

This is an iterative process!





Demo recap

- Tooling allows us to identify problematic images:
 - Similar appearance
 - Automatic classification
 - Influence on training process

Demo recap

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 - **Similar appearance**
 - Automatic classification
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Demo recap

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 - Similar appearance
 - **Automatic classification**
 - Influence on training process



Demo recap

- Tooling allows us to identify problematic images:
 - Similar appearance
 - Automatic classification
 - **Influence on training process**



Demo recap

- Tooling allows us to identify problematic images:
 - Similar appearance
 - Automatic classification
 - Influence on training process
- **Act on them in real-time!**
- **Custom tooling: quickly add / explore new AI-assisted approaches**
 - Needed for scalable data iteration
 - 30M images in total
 - Terabytes of data!

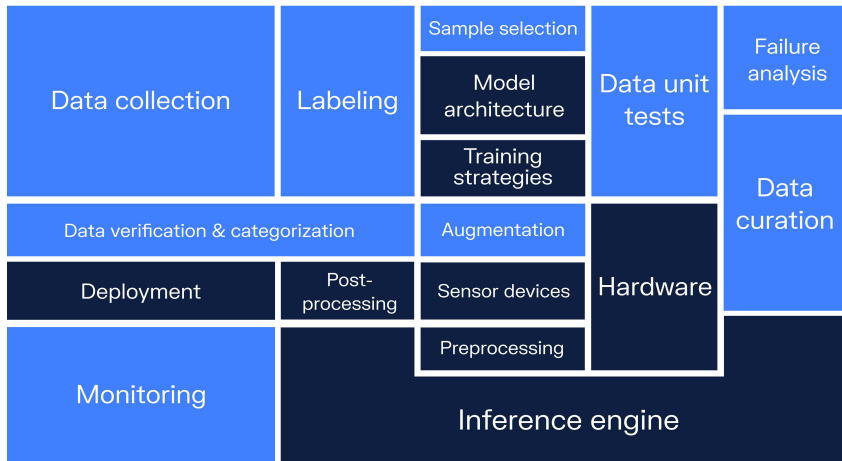
Conclusion

Production-worthy tinyML requires:

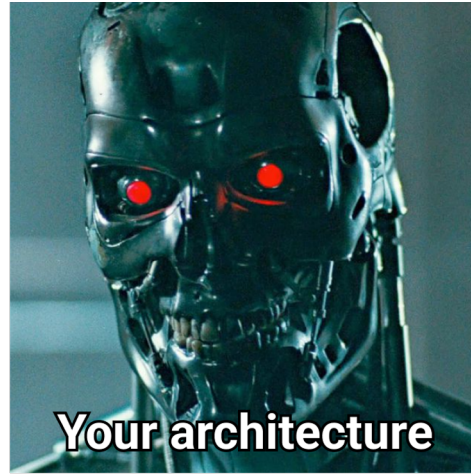
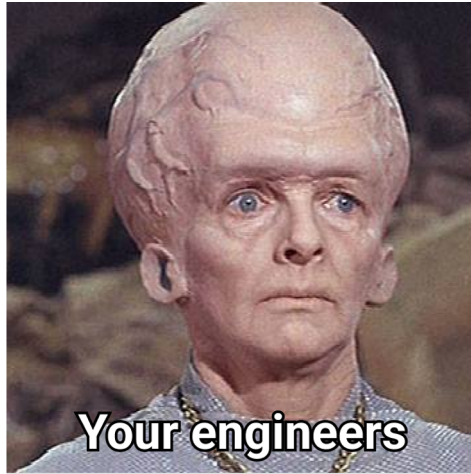
- **Vertical integration!**
- Rapid iteration
- High-quality data



High-quality model!



Questions



Not part of a
healthy diet!

Thank you!



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arm

ASPINITY

brainchip*
The Neuromorphic Computing Company

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