tinyML® Summit

Miniature dreams can come true...

March 28-30, 2022 | San Francisco Bay Area

www.tinyML.org

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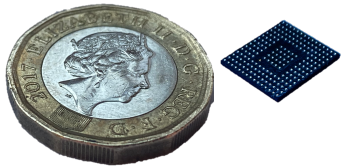
Tiny models with big appetites: Cultivating the perfect data diet

Jelmer Neeven - jelmer@plumerai.com

TinyML Summit - March 29th, 2022

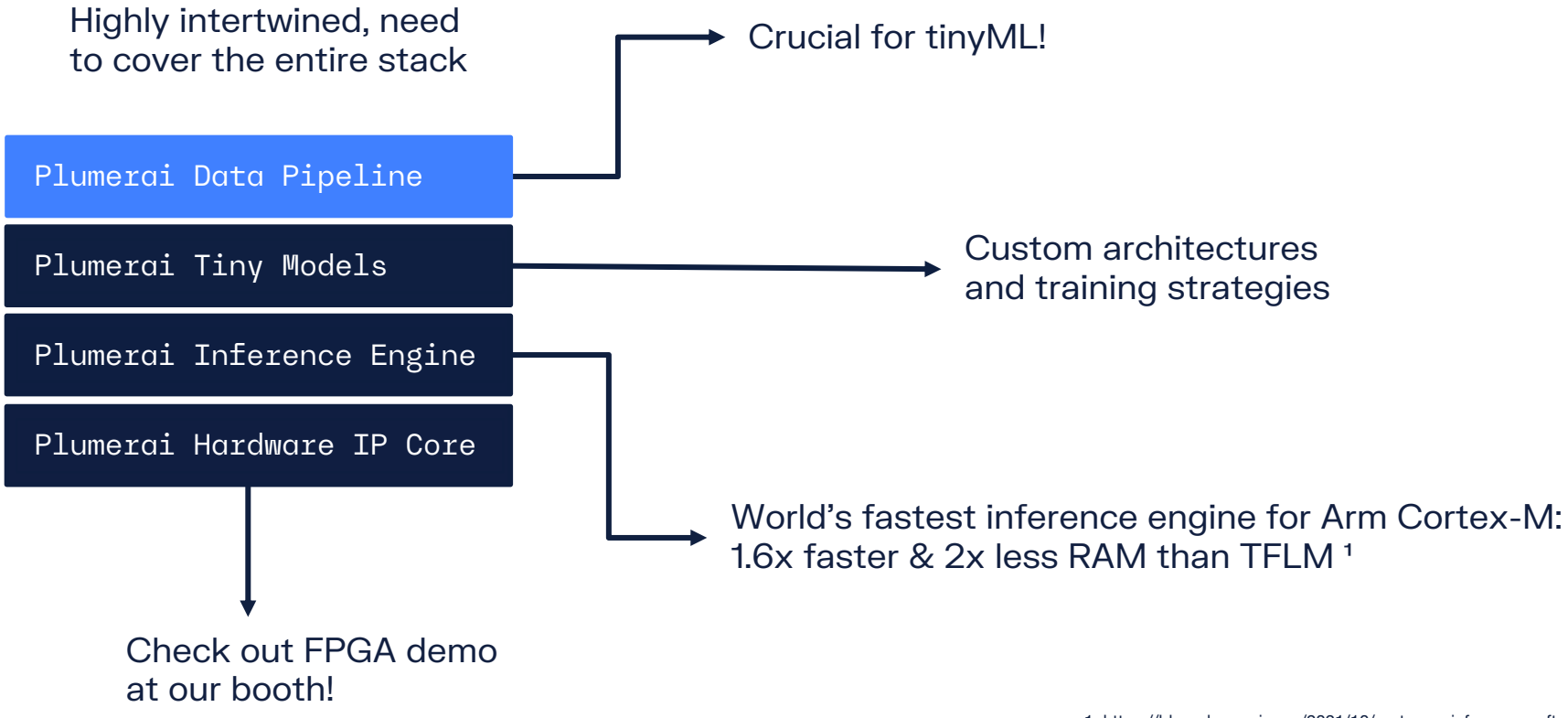
Plumerai people detection

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?

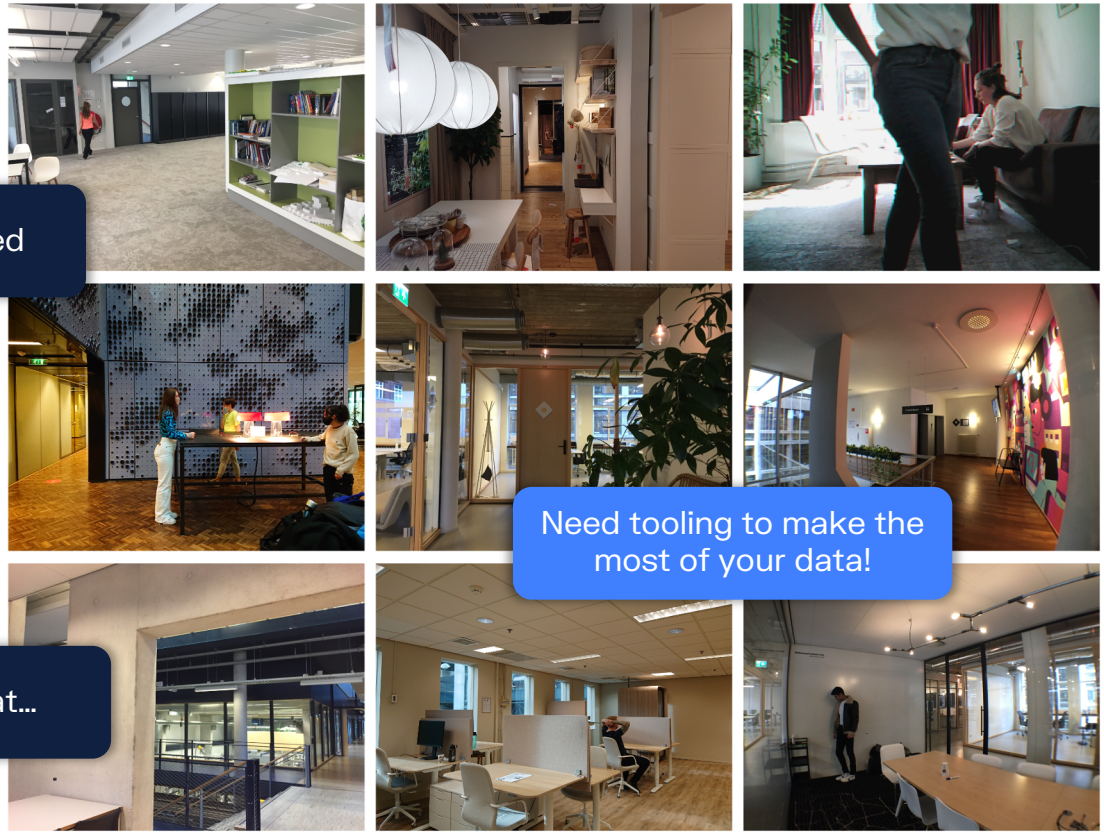


1. https://blog.plumerai.com/2021/10/cortex-m-inference-software/

Why not just use public data?

Plumerai dataset

Not person-centered



Need tooling to make the most of your data!

Nothing to look at...

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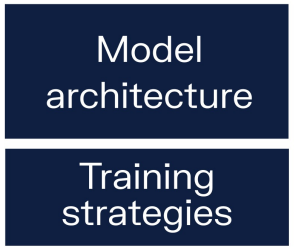
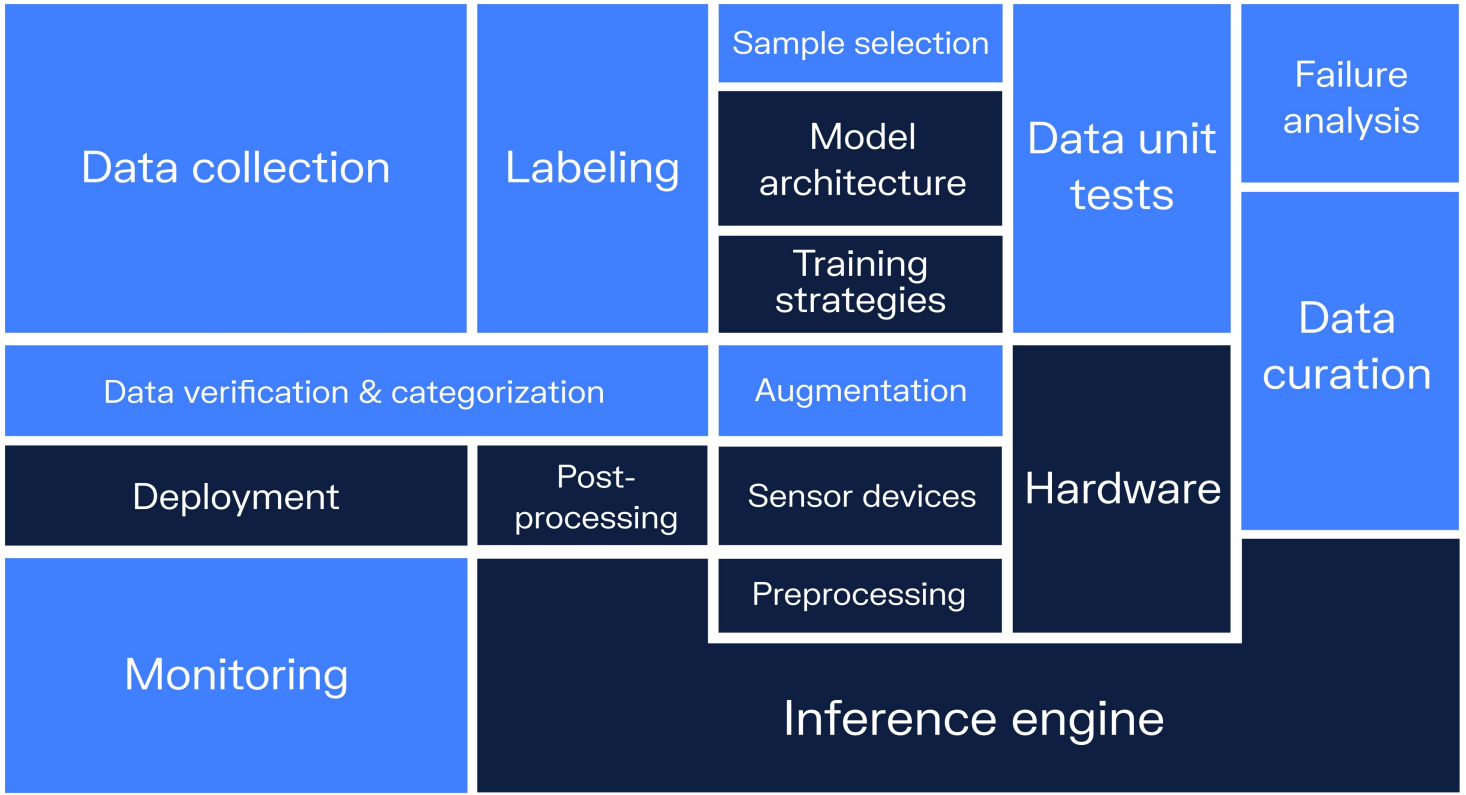
Plumerai infrastructure

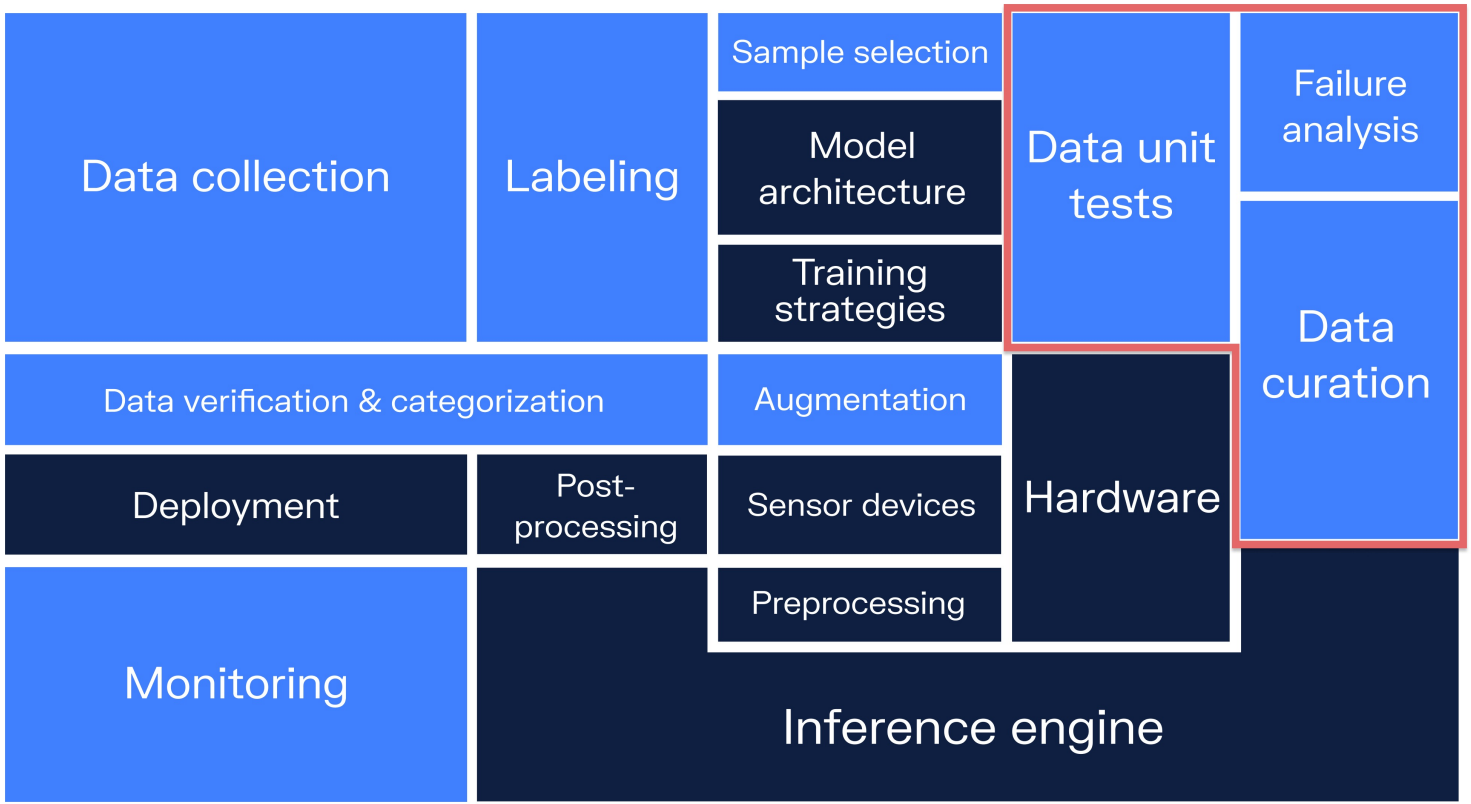
Infrastructure overview



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

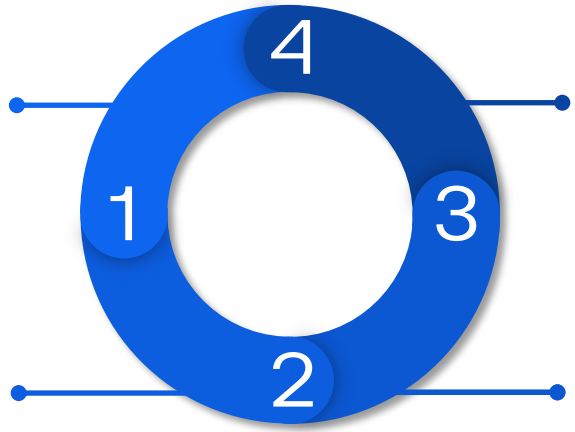
Edge cases

Data curation cycle

Need **good data tooling** to:

Test-driven development

This is an iterative process!



Identify failure cases

Re-train model

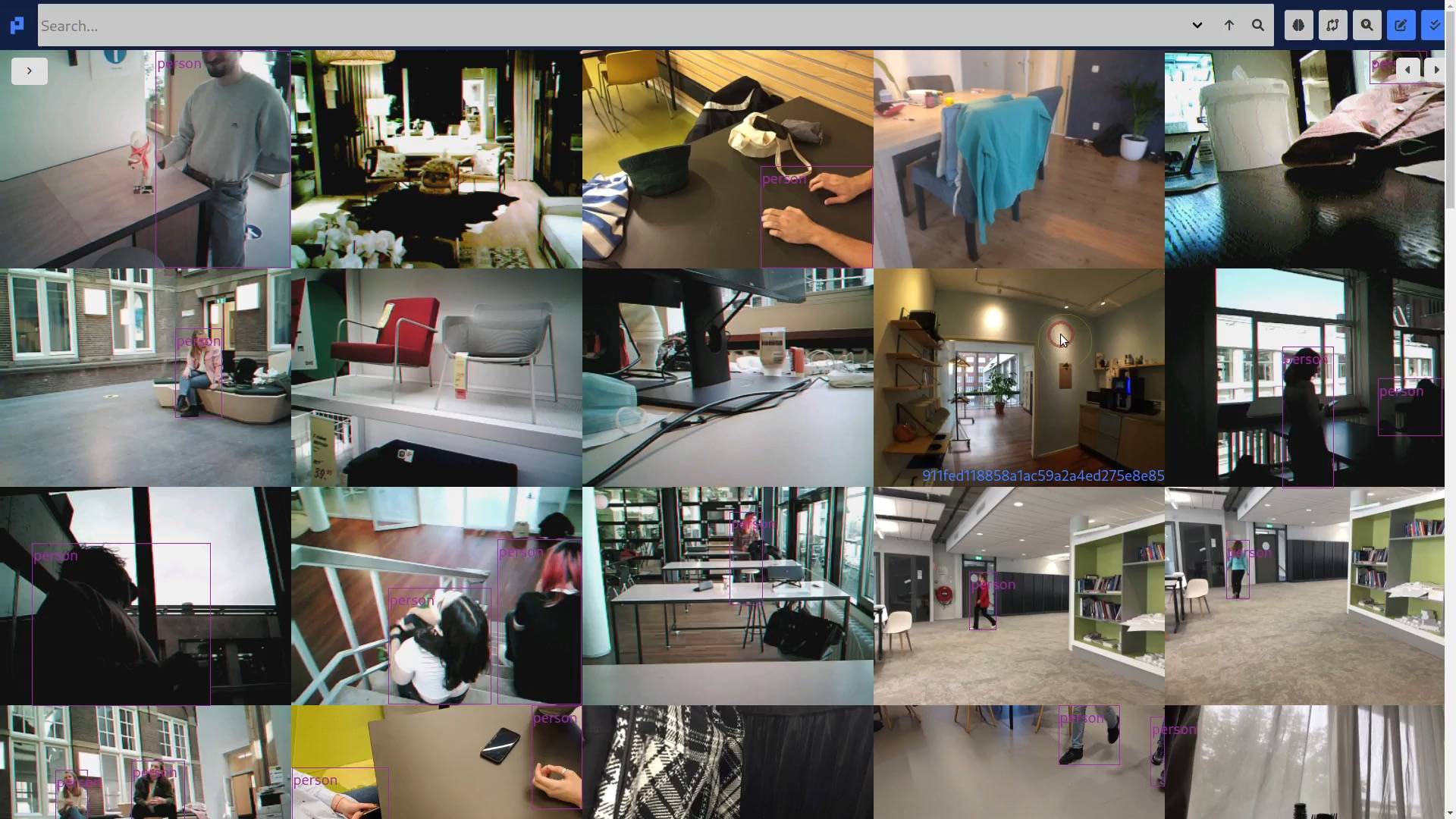
Link problem to training data:

- Visual similarity
- Interactive classification
- Training influence
- …

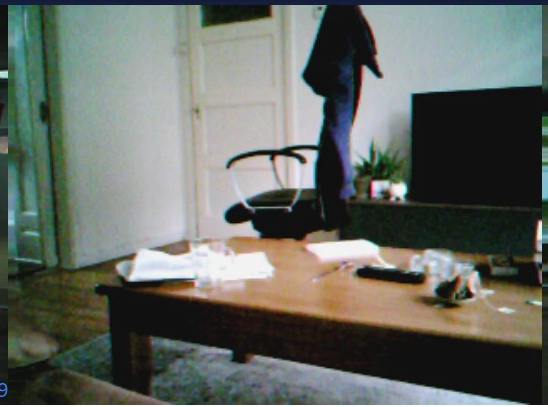
Address problems

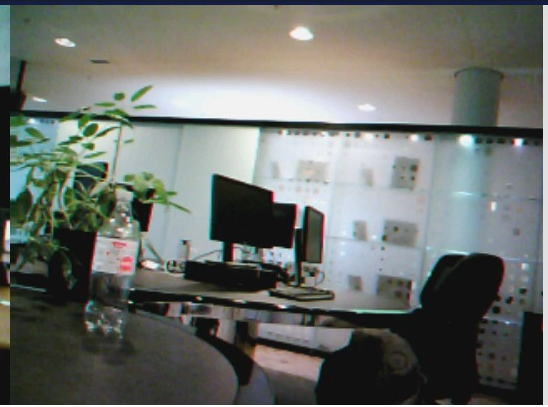
- Correct labels
- Oversampling
- Targeted augmentation
- Supervised Contrastive Learning
- Add / **remove** data
- …

Quality > quantity


Search...
person
911fed118858a1ac59a2a4ed275e8e85

'tinyML_IF_example' in unnest(tags)





Demo recap

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

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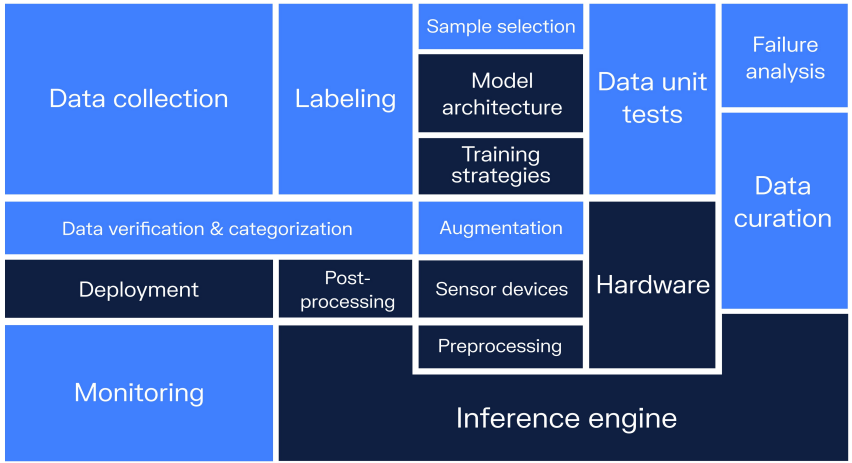
- **Act on them in real-time!**
- **Custom tooling: quickly add / explore new AI-assisted approaches**
  - Needed for scalable data iteration
  - 30M images in total
  - Terabytes of data!

Conclusion

Production-worthy tinyML requires:

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

High-quality model!



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Questions

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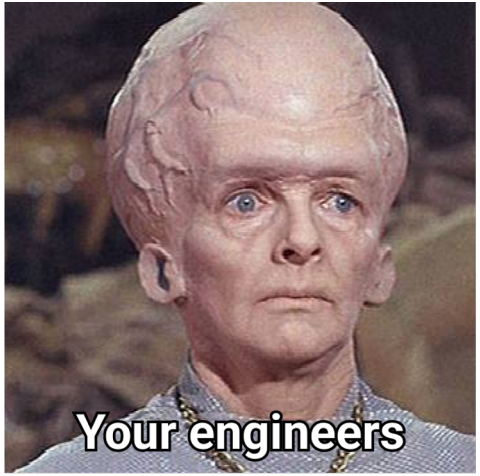

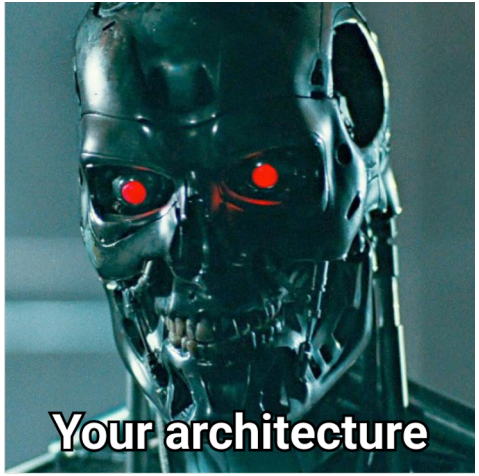

Not part of a healthy diet!

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Thank you!

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