

Hierarchies in RL

Saurabh Gupta

Solving a RL Problem

Better Optimization

Better Reward Signals

Convert into a
Supervised Training
Problem

Solve a Related but
Supervision-rich Problem

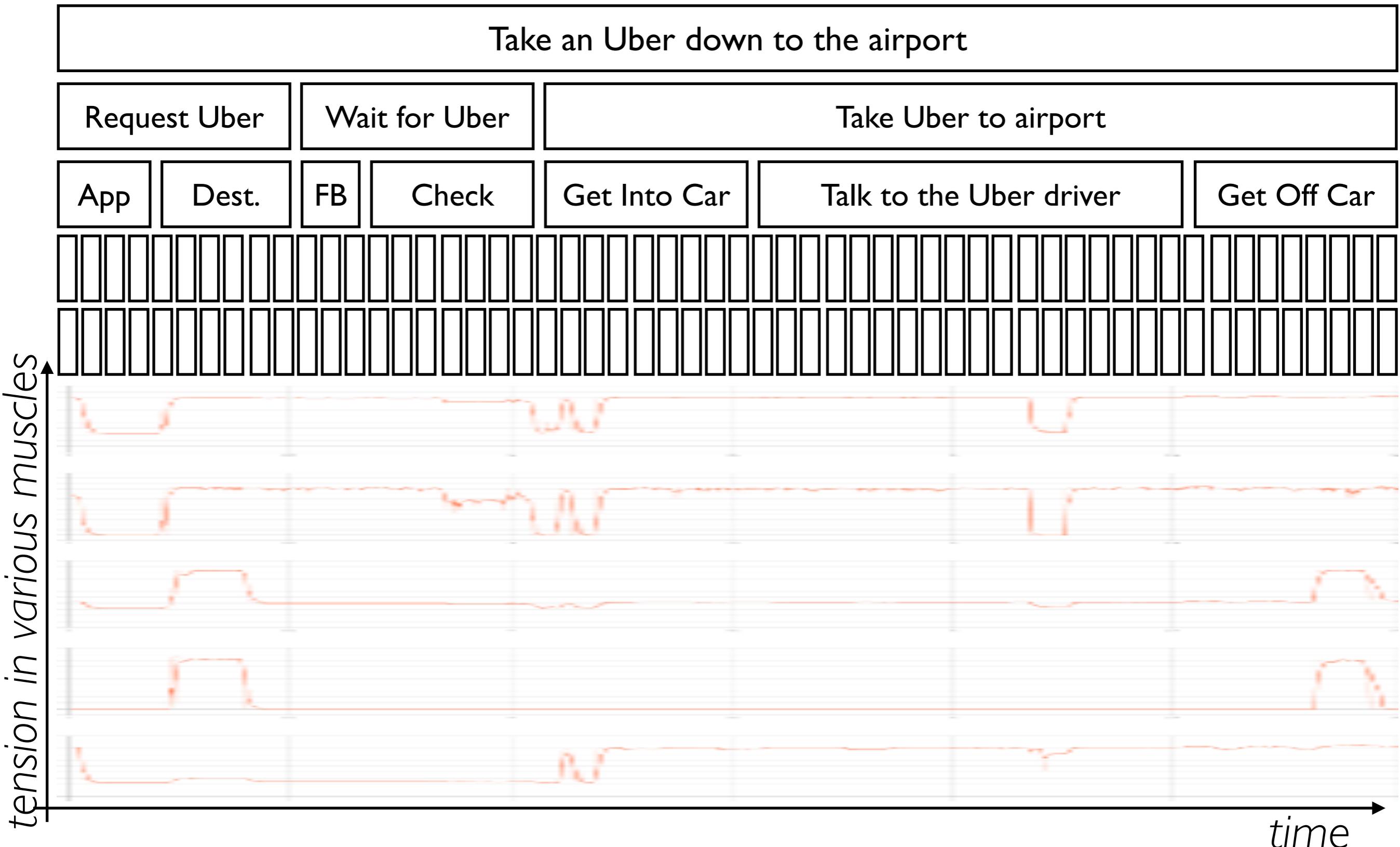
Build Models and Plan
with Them

Model-free RL
with sparse
rewards

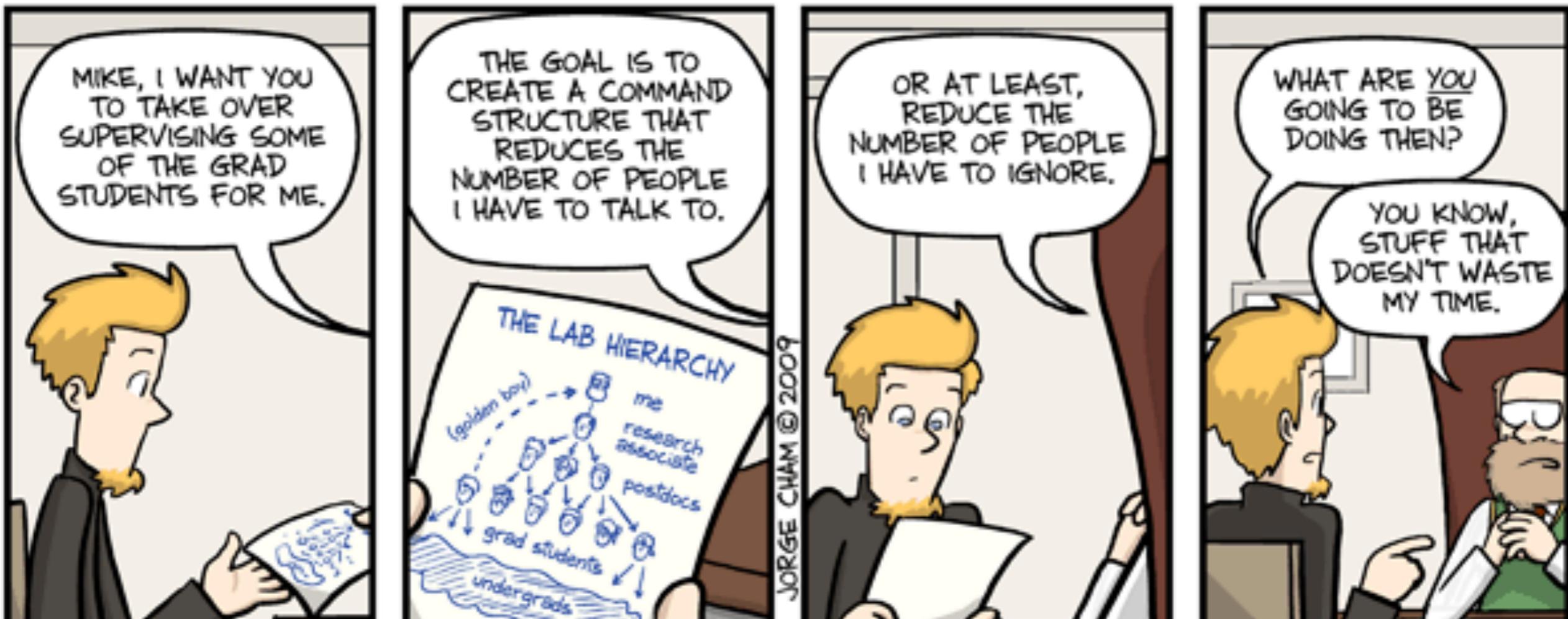
Known reward,
known model.
Model-based RL

Hierarchies

Think about going to the airport.

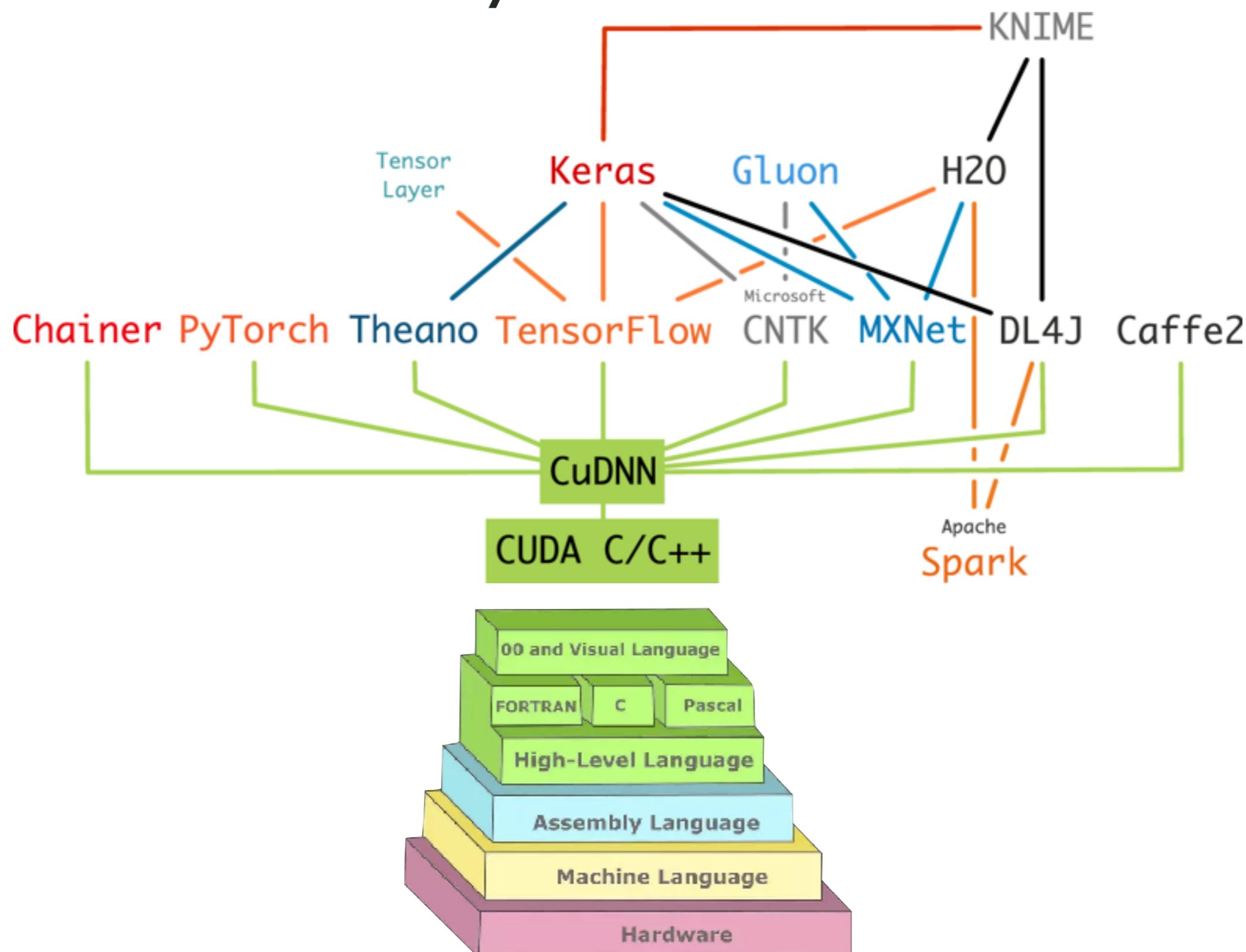


Hierarchies are everywhere



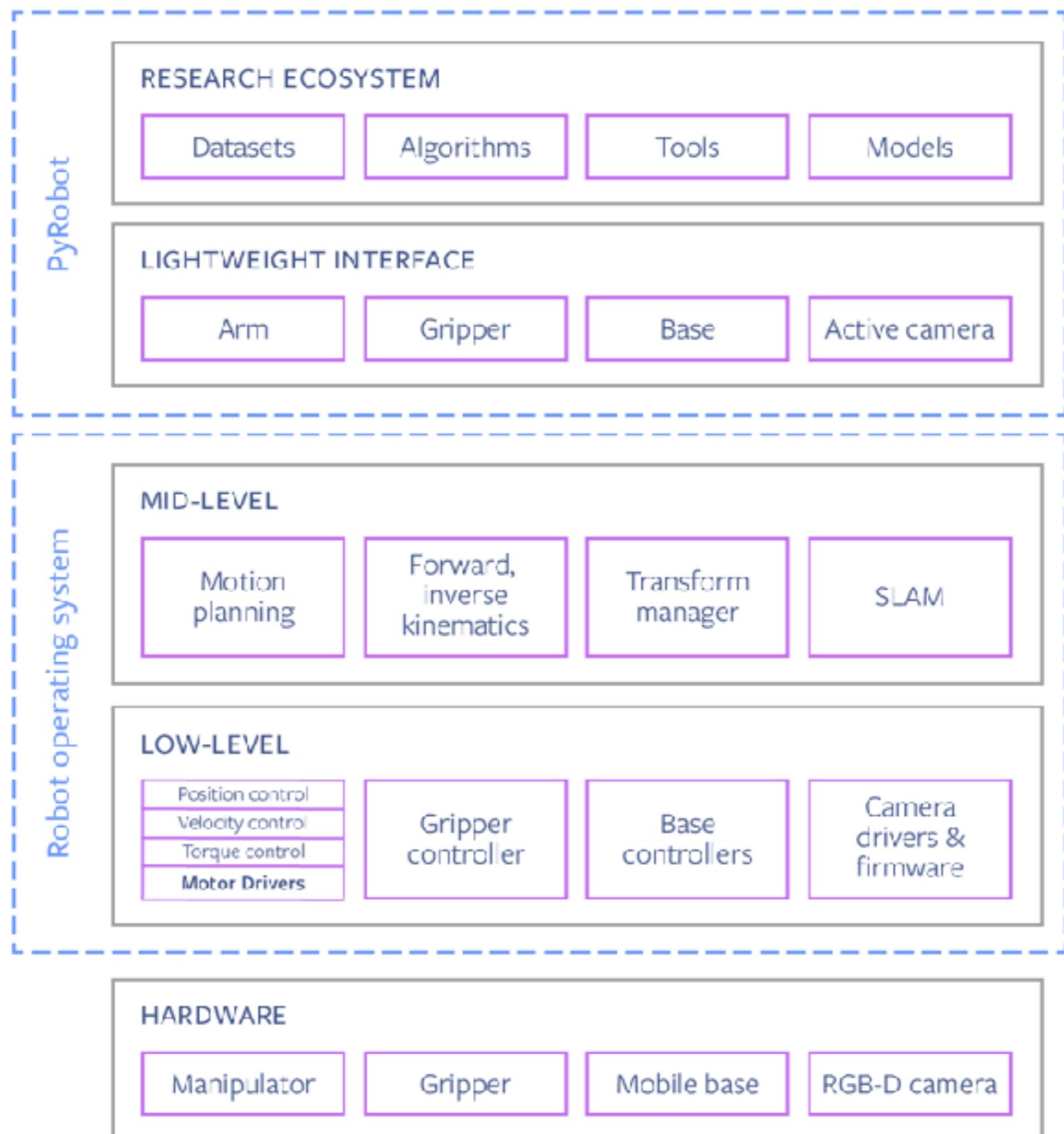
WWW.PHDCOMICS.COM

Hierarchies are everywhere

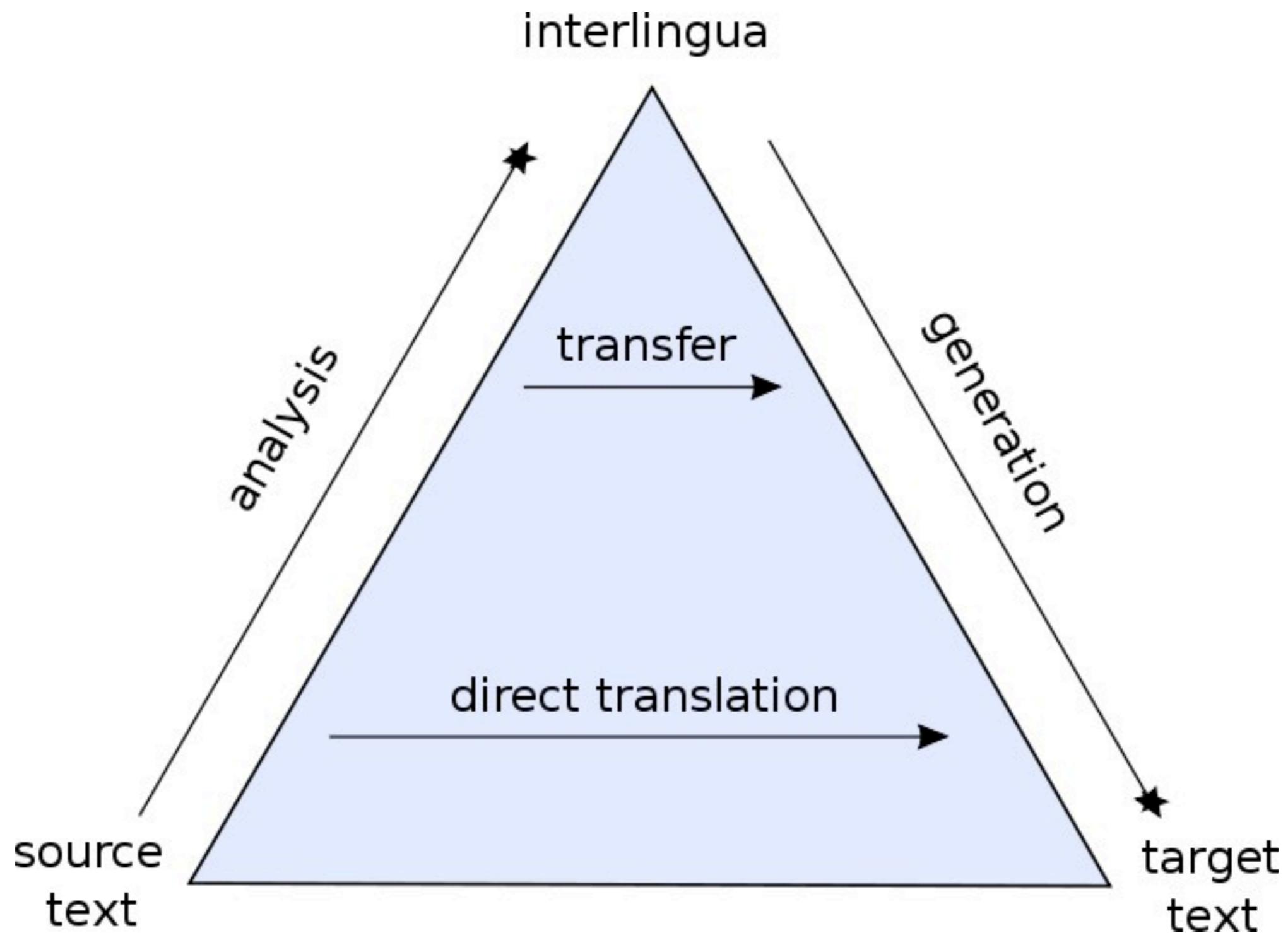


Source: Machine Learning and Deep Learning frameworks and libraries for large-scale data mining: a survey,
<https://www.scienceabc.com/innovation/why-are-there-so-many-programming-languages.html>

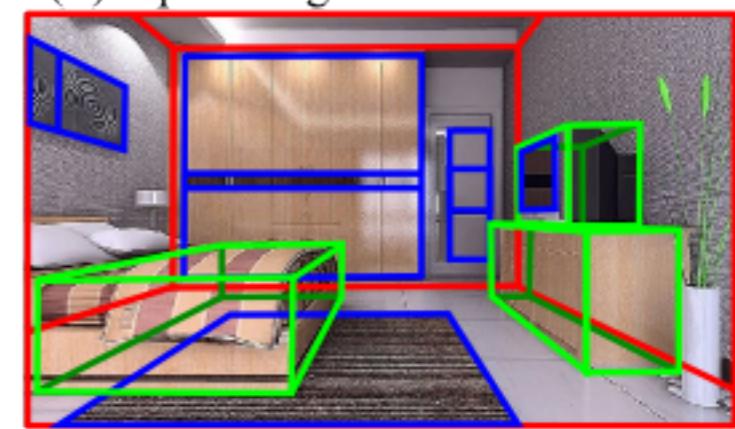
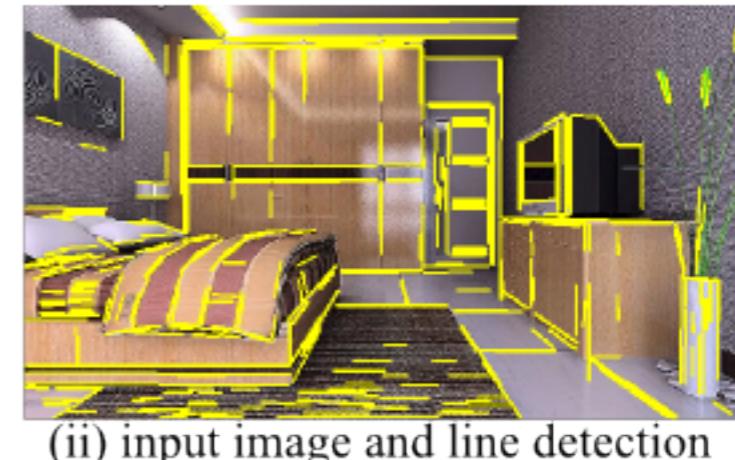
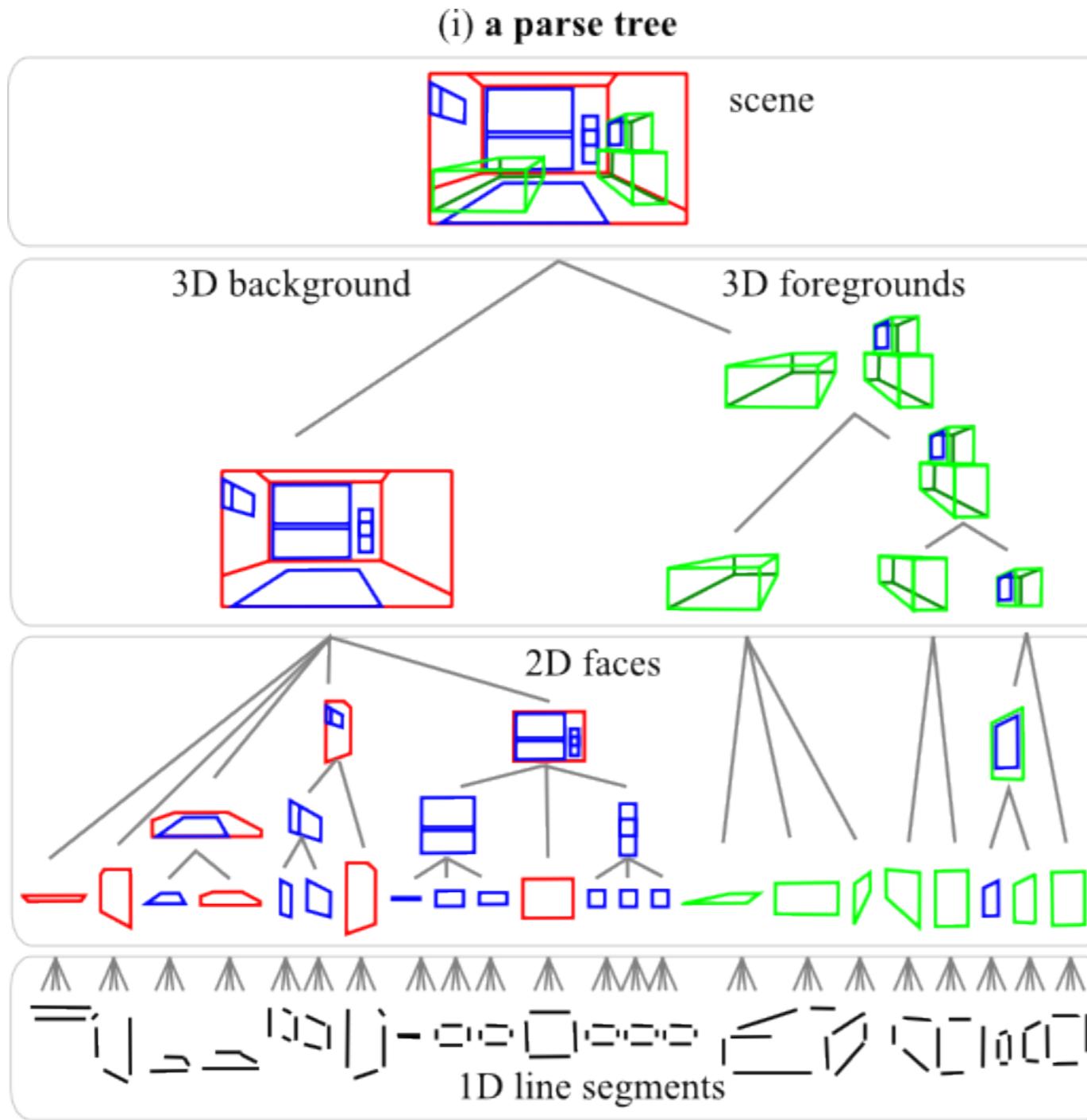
Hierarchies are everywhere



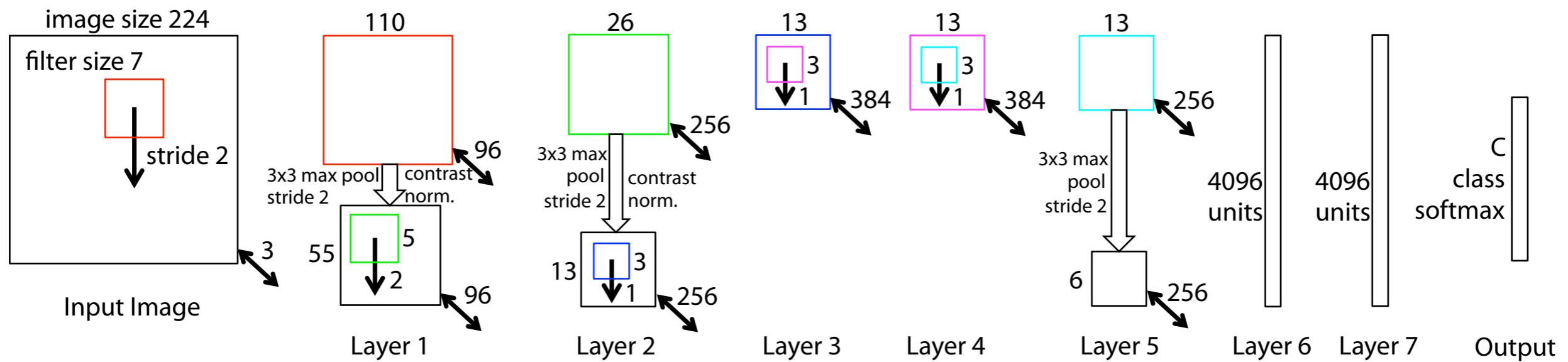
Hierarchies are everywhere



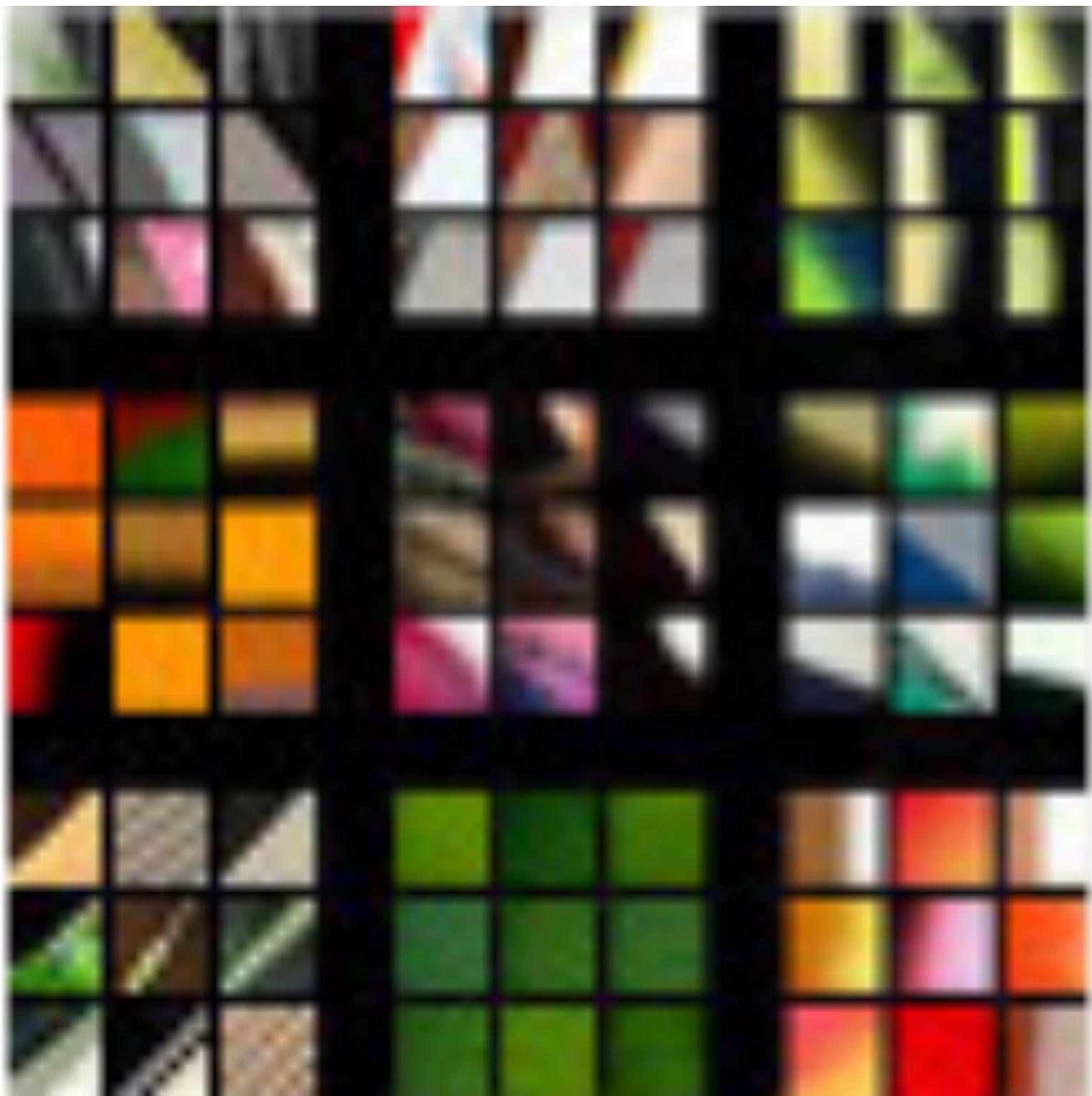
Hierarchies are everywhere



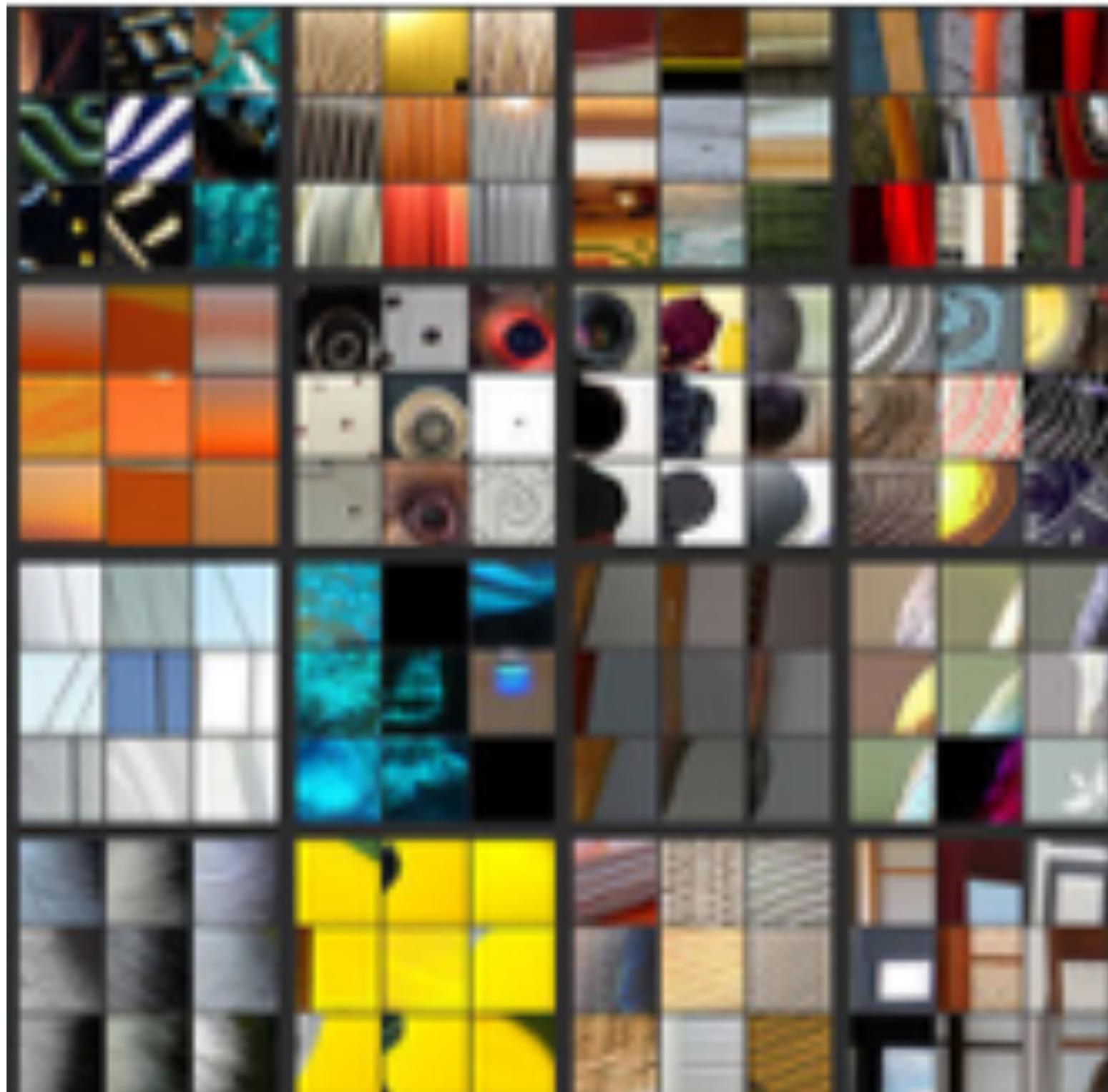
Hierarchies are everywhere



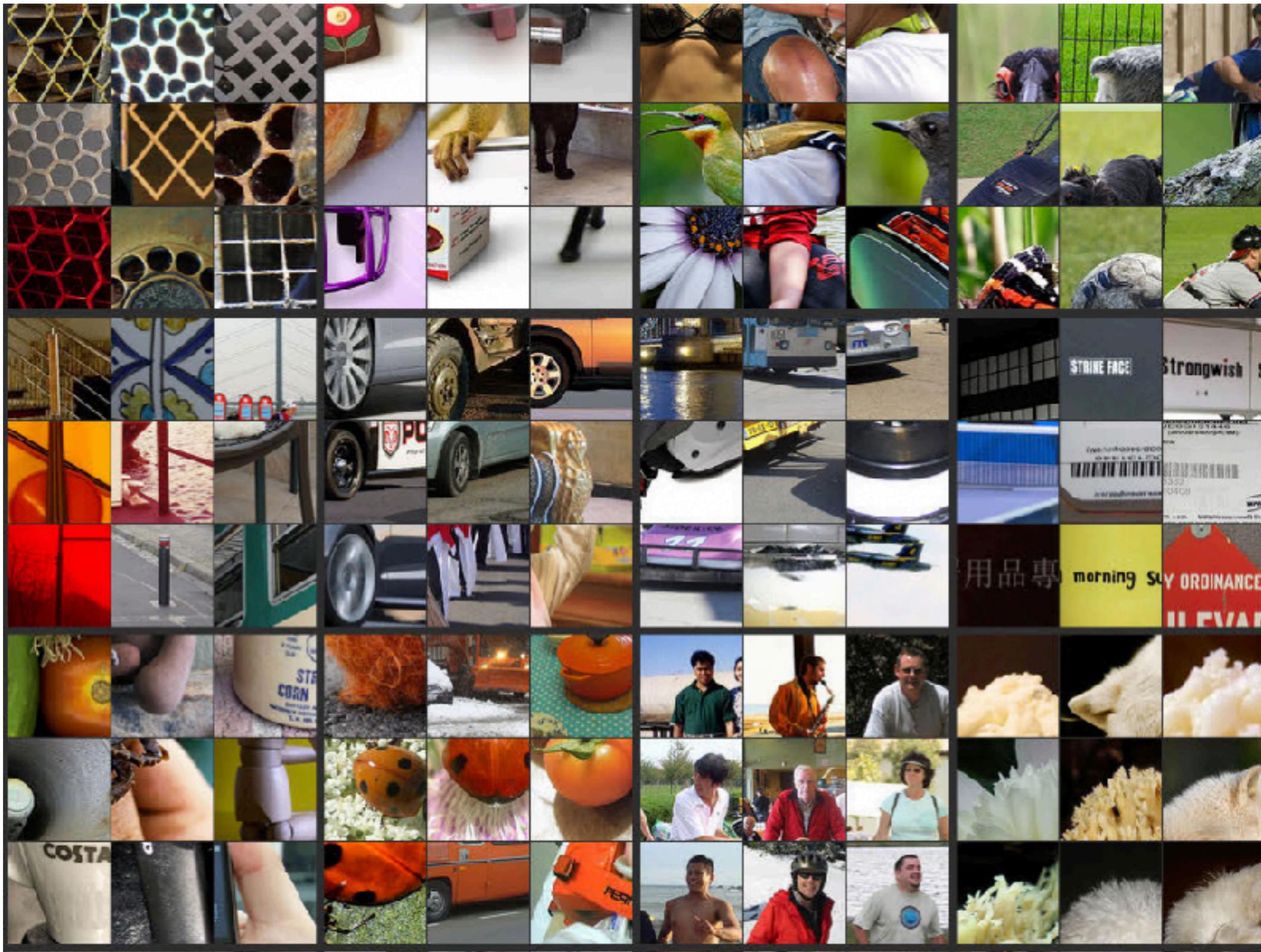
Hierarchies are everywhere



Hierarchies are everywhere



Hierarchies are everywhere



Hierarchies are everywhere

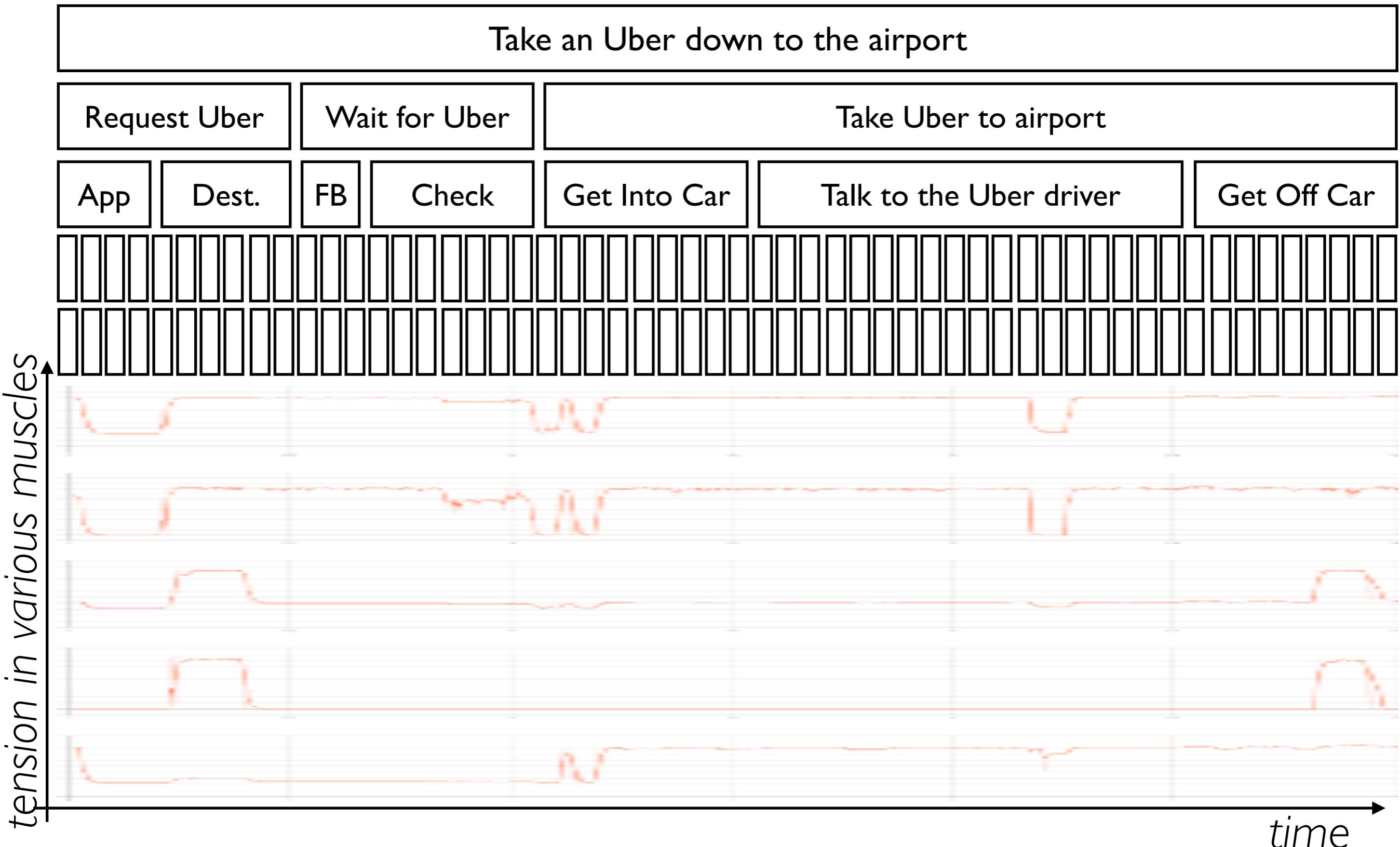


Hierarchies are everywhere



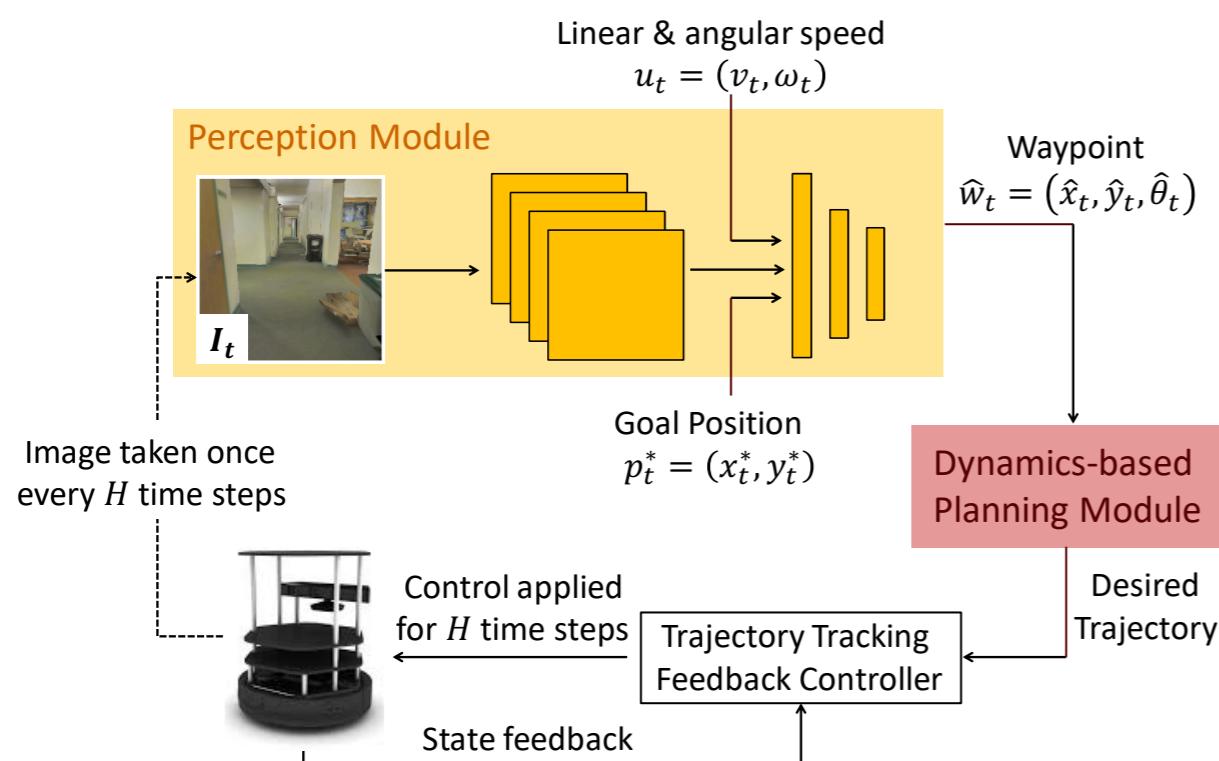
Hierarchies

Think about going to the airport.



Hierarchical Policies

- High-level policy generates sub-goals for low-level policies
- High-level policy appropriately invoke low-level behaviors



Hierarchies (discussion)

1. A: Why might we want to use hierarchies?
2. B: Why might we not want to use hierarchies?

Why do we care about hierarchies?

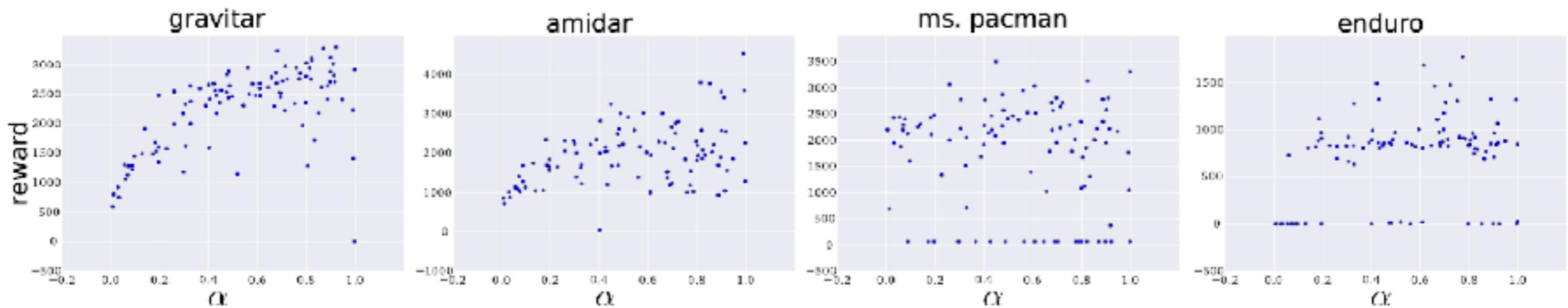
1. Shorter time horizons
2. Efficiency (learning, inference)
3. Sharing, and reusability

Then, why isn't everyone using them?

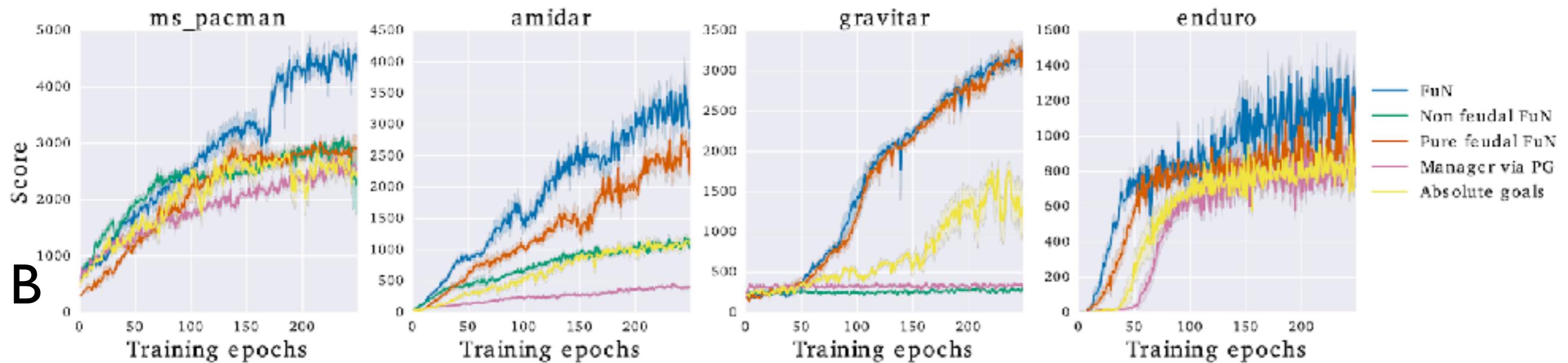
1. Hierarchies can introduce inefficiencies.
2. Learning inside a hierarchy is still easy, but learning the hierarchy has proved to be very, very hard.

a) Key take-away (authors), b) Key take-away (yours), c) additional comparisons?

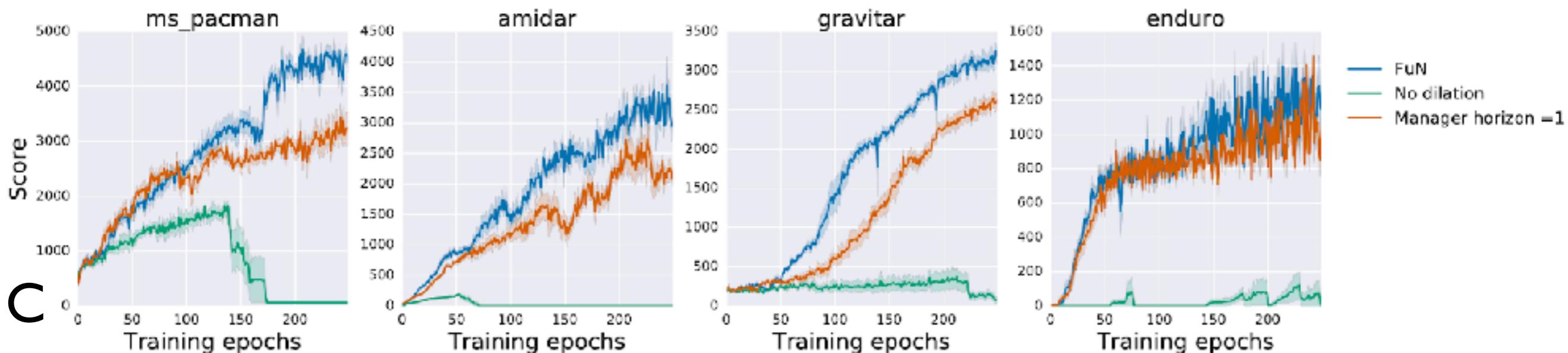
A



B



C



Thank you