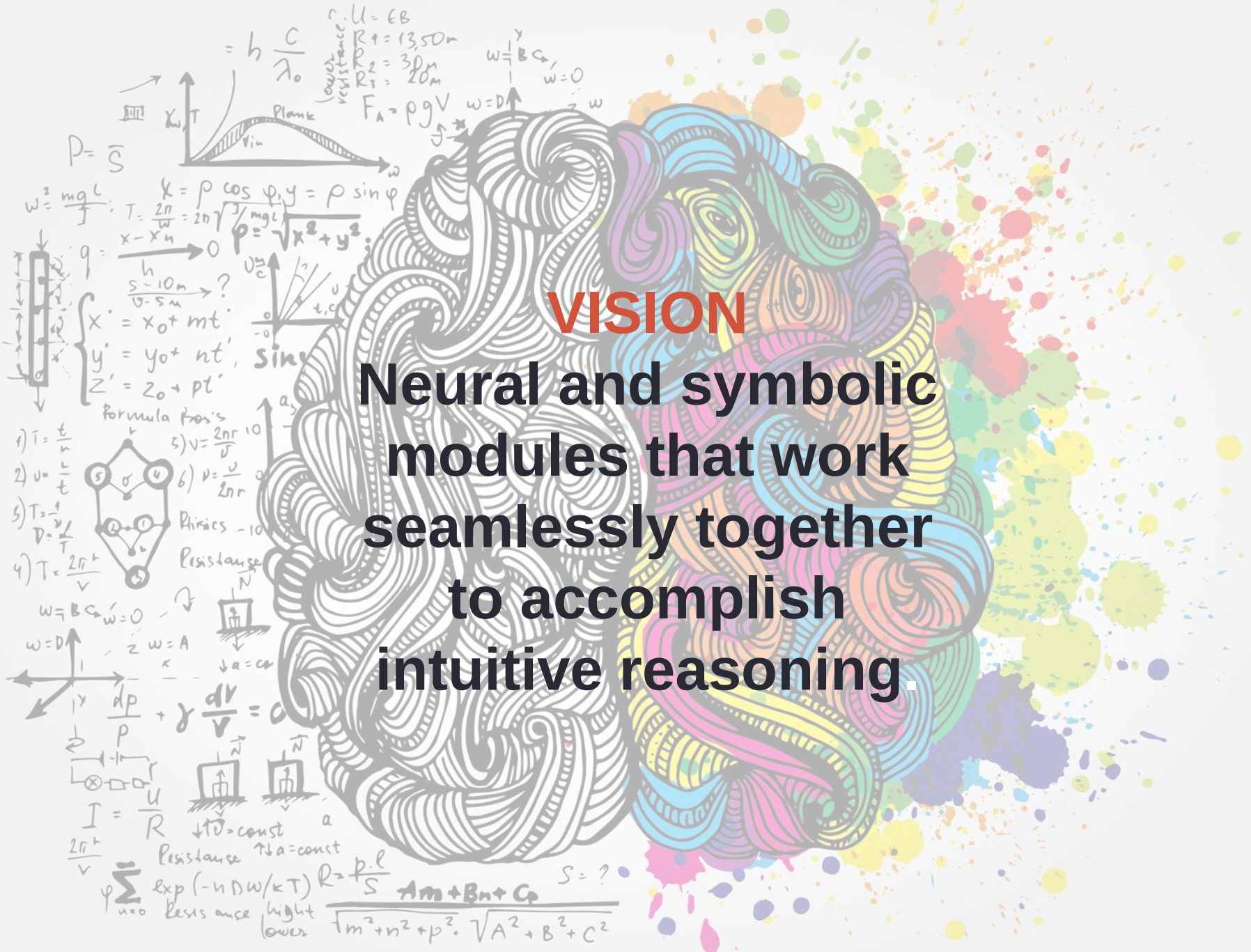
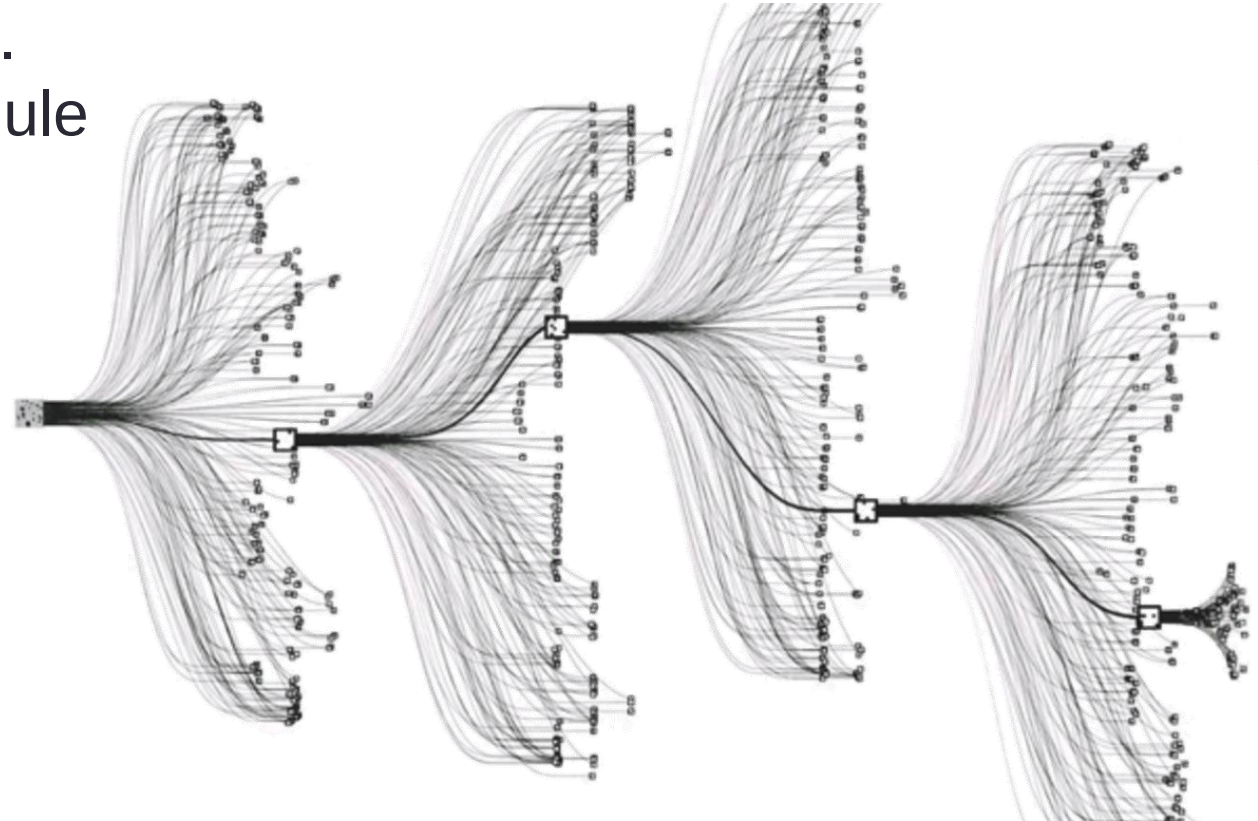
Machine Reasoning and Deep Spiking Networks

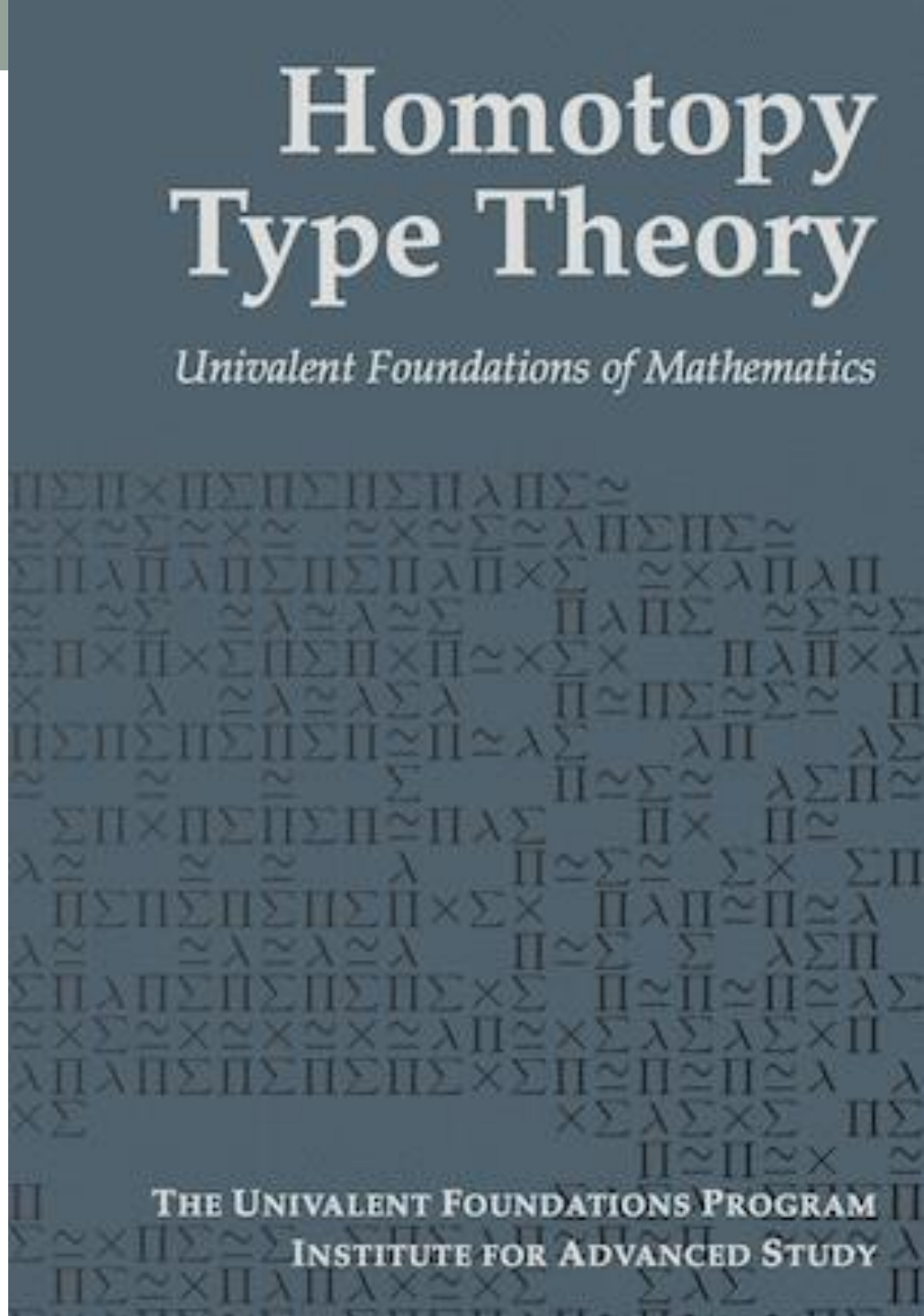
Shaowei Lin
Assistant Professor
Engineering Systems and Design
Singapore University of Technology and Design

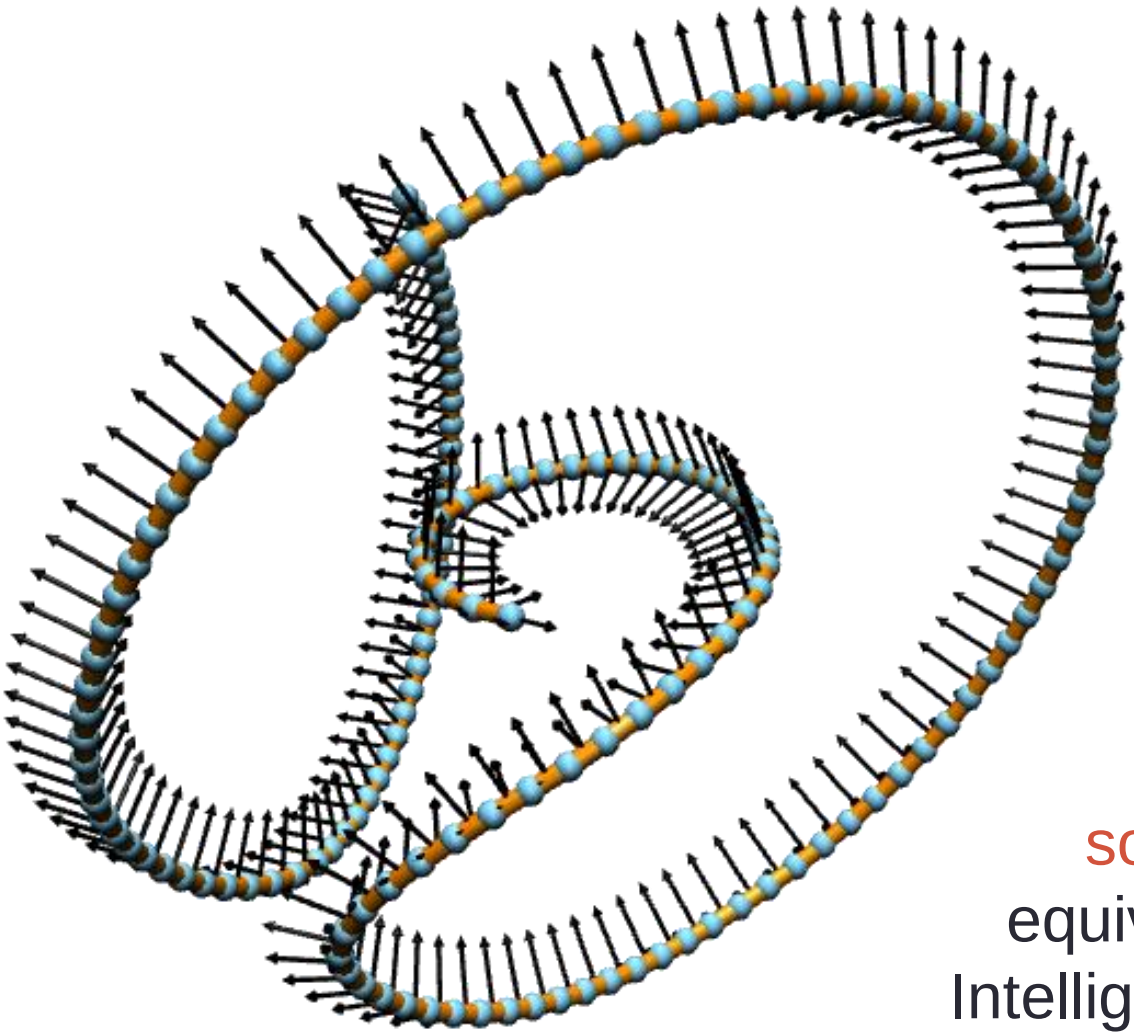

VISION
Neural and symbolic modules that work seamlessly together to accomplish intuitive reasoning.

Every symbolic module has a language (e.g. Turing machine, memory vectors, game trees, first-order logic). The neural module learns to speak this language.



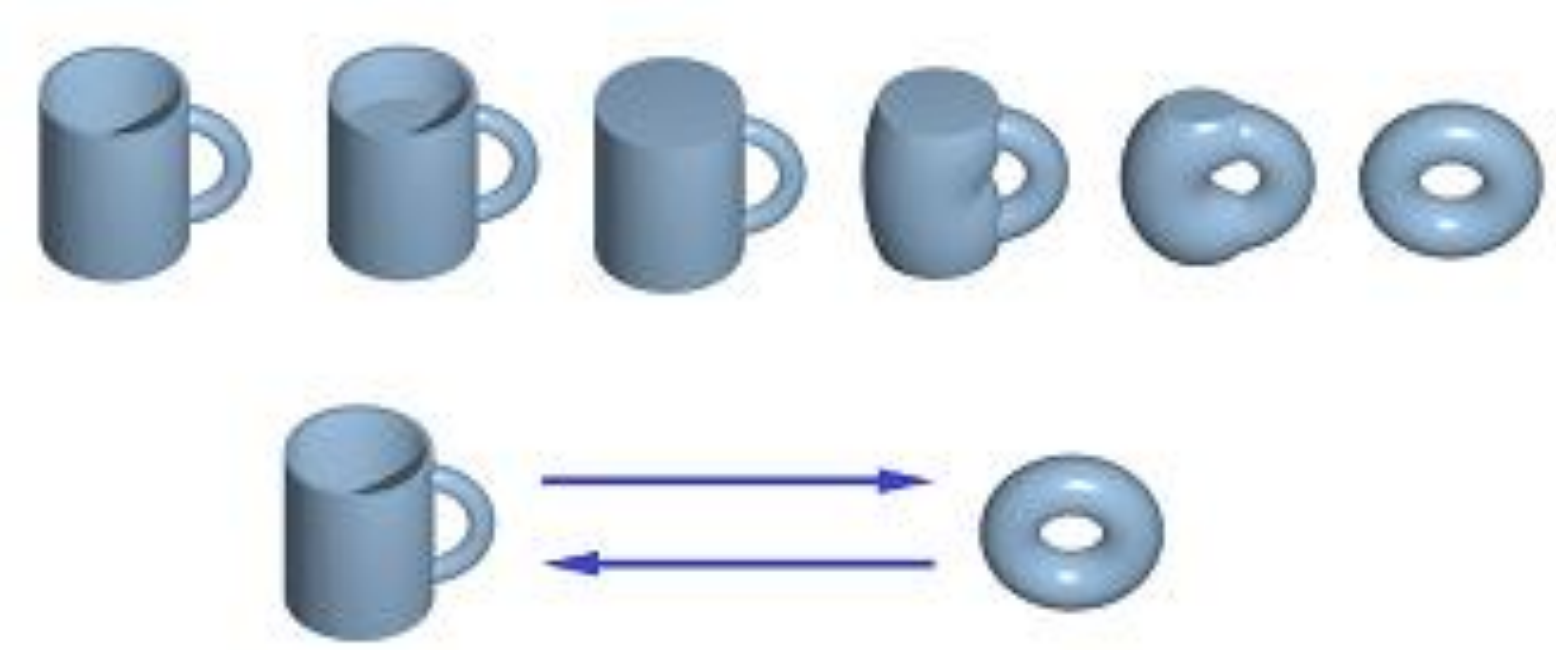
Find a language logical enough to describe all intents, yet computational enough to describe all implementations.

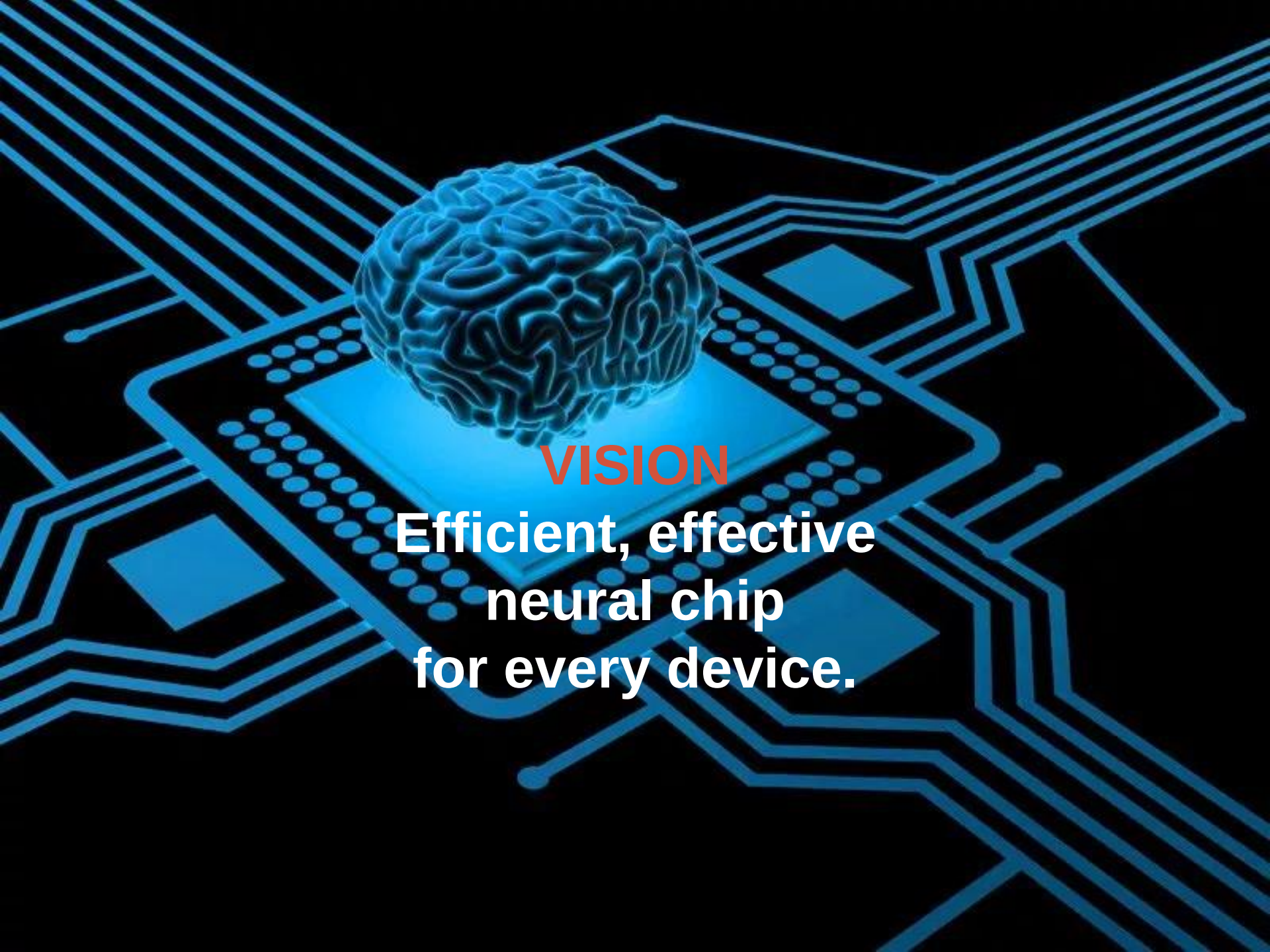




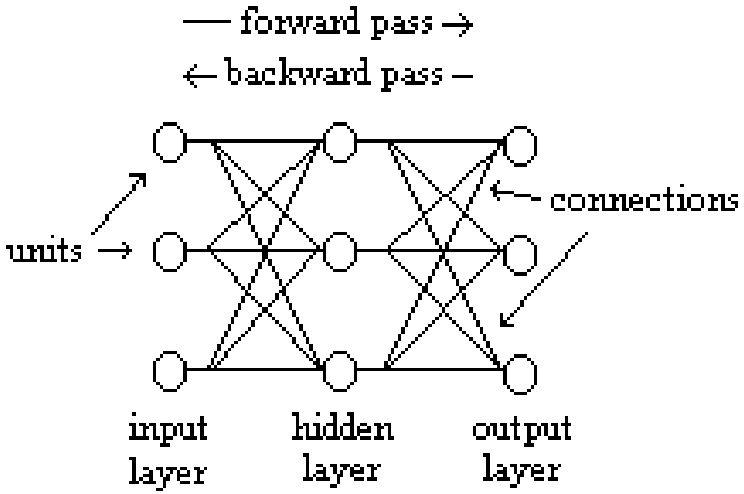
Generalization
is transporting
solutions between
equivalent problems.
Intelligence is all about
learning equivalences.

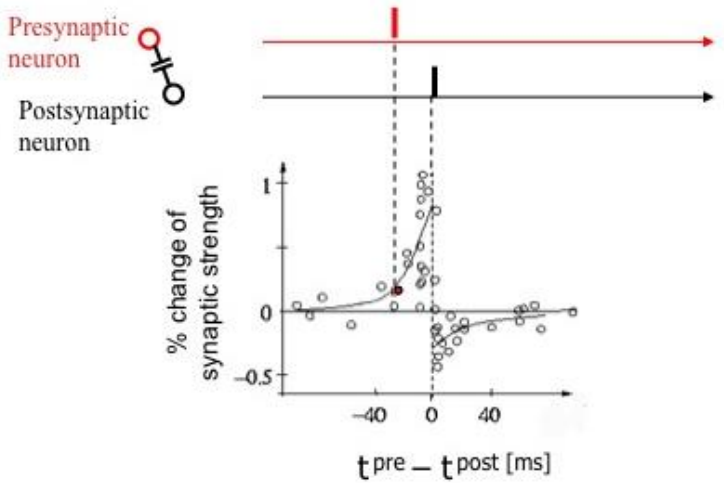
Equivalence between terms of a type
is indistinguishable from
paths between points of a space.



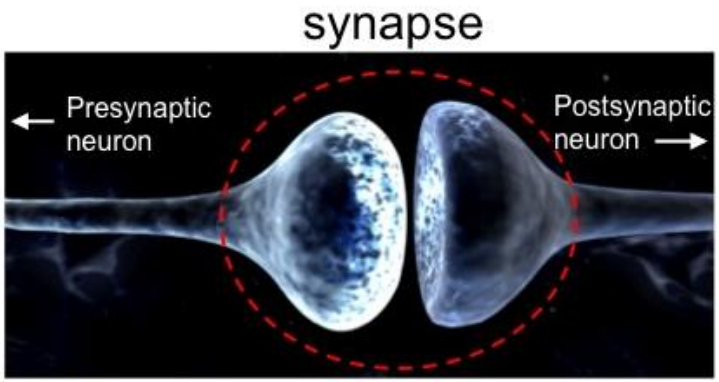

VISION
Efficient, effective
neural chip
for every device.

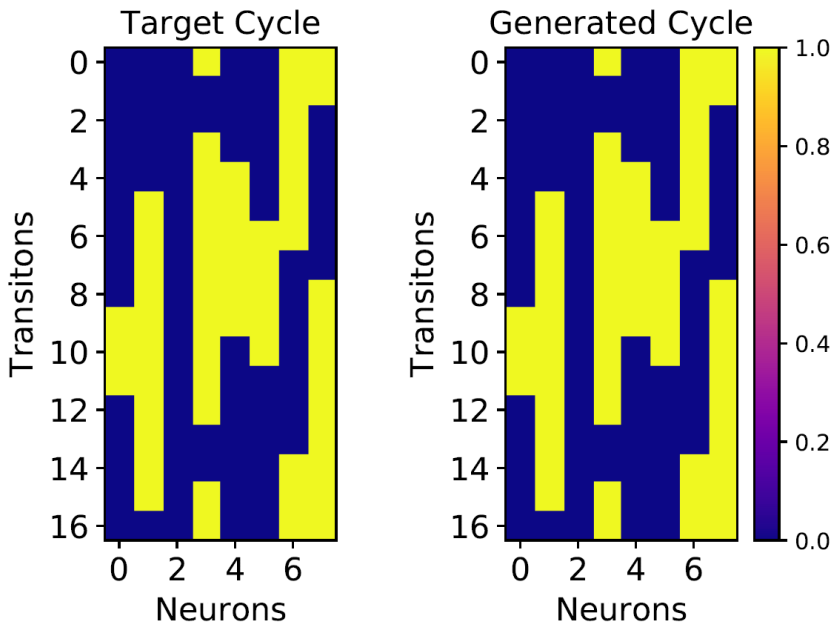
Prediction and learning
should be event-driven
for energy-efficiency.

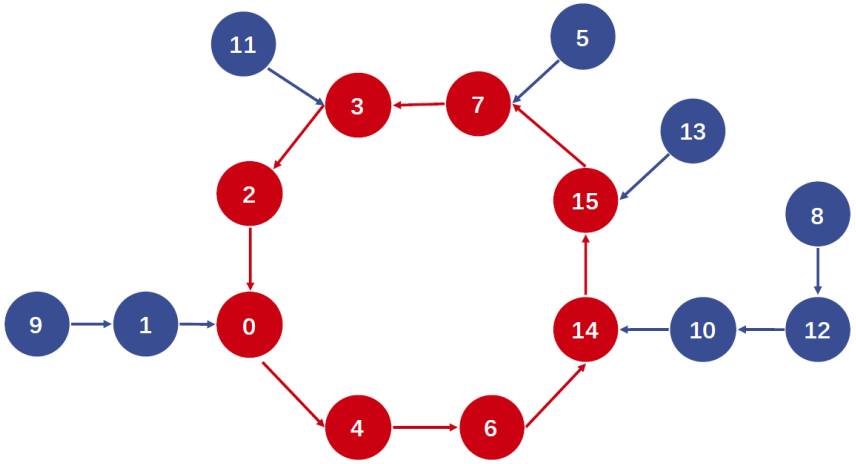




In learning,
communication
is time-consuming,
so algorithms should depend,
not on global messages,
but on local ones.







Intelligence is
equivalence-learning,
so we should focus,
not on learning points or states,
but on learning paths or sequences.

Represent paths,
not using continuous states in discrete time,
but using discrete states in continuous time.