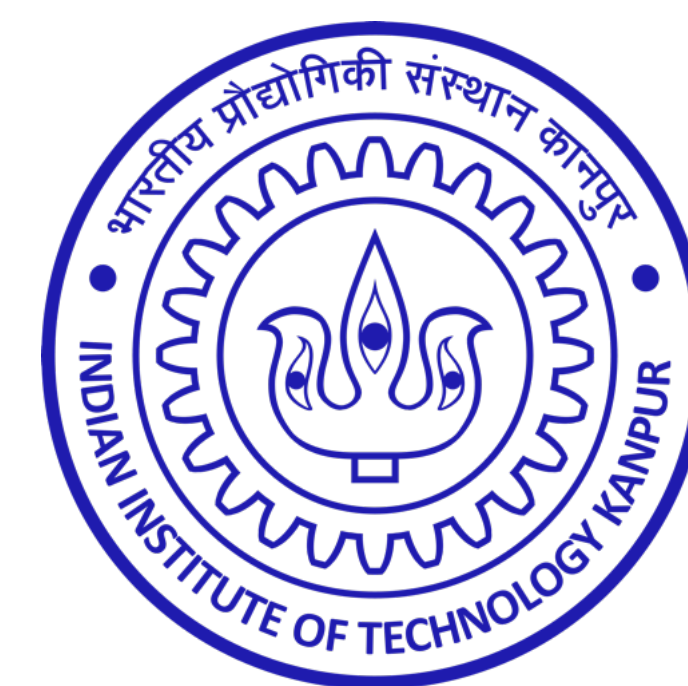


Learning to Play Video Games with Intuitive Physics Priors

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Core Knowledge for Human Like Game Playing

Systems of Core Knowledge

Places

Distance and Direction

Objects

Cohesion, Continuity,
Action on Contact

Number

Relative Magnitude

Forms

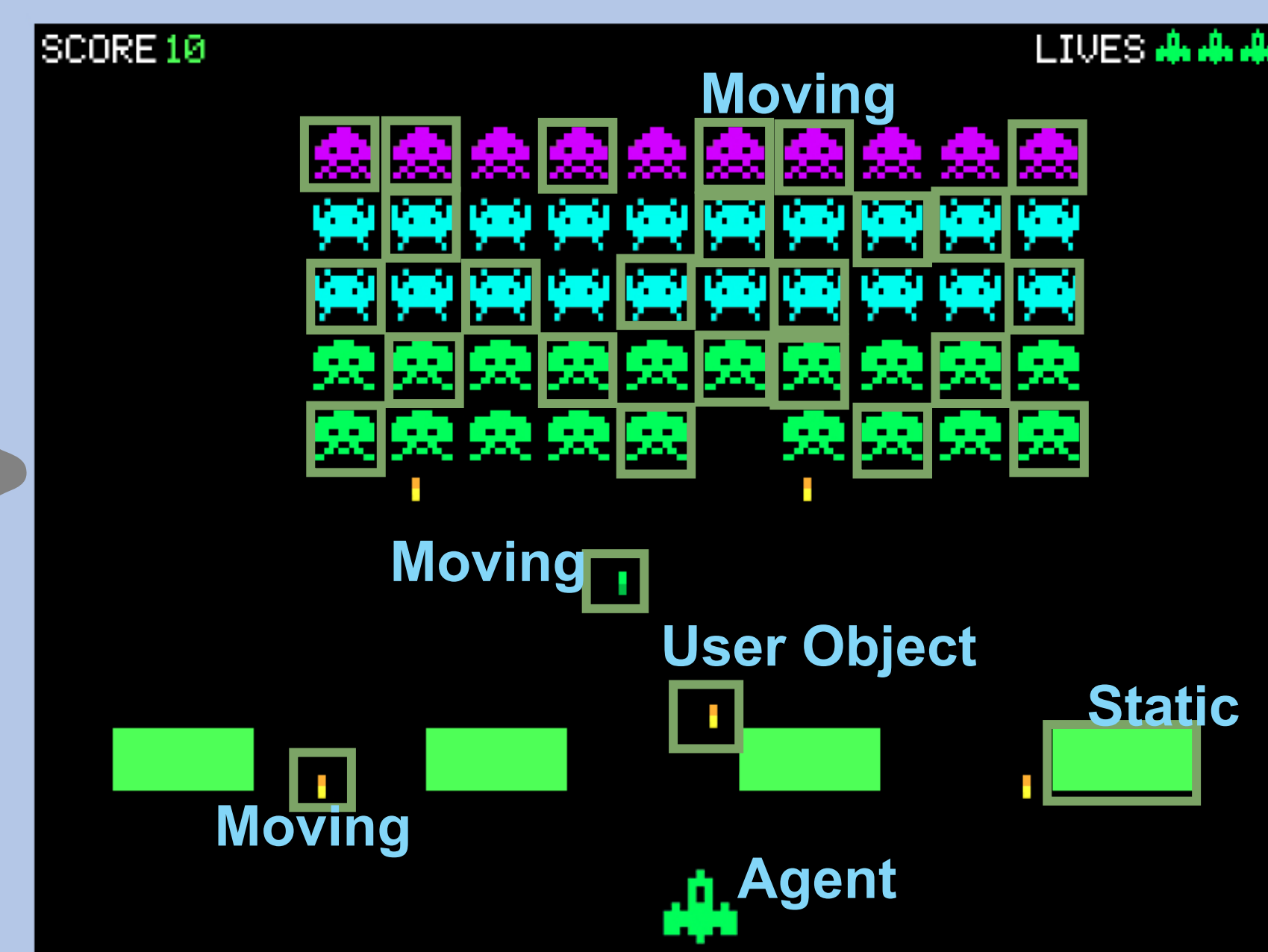
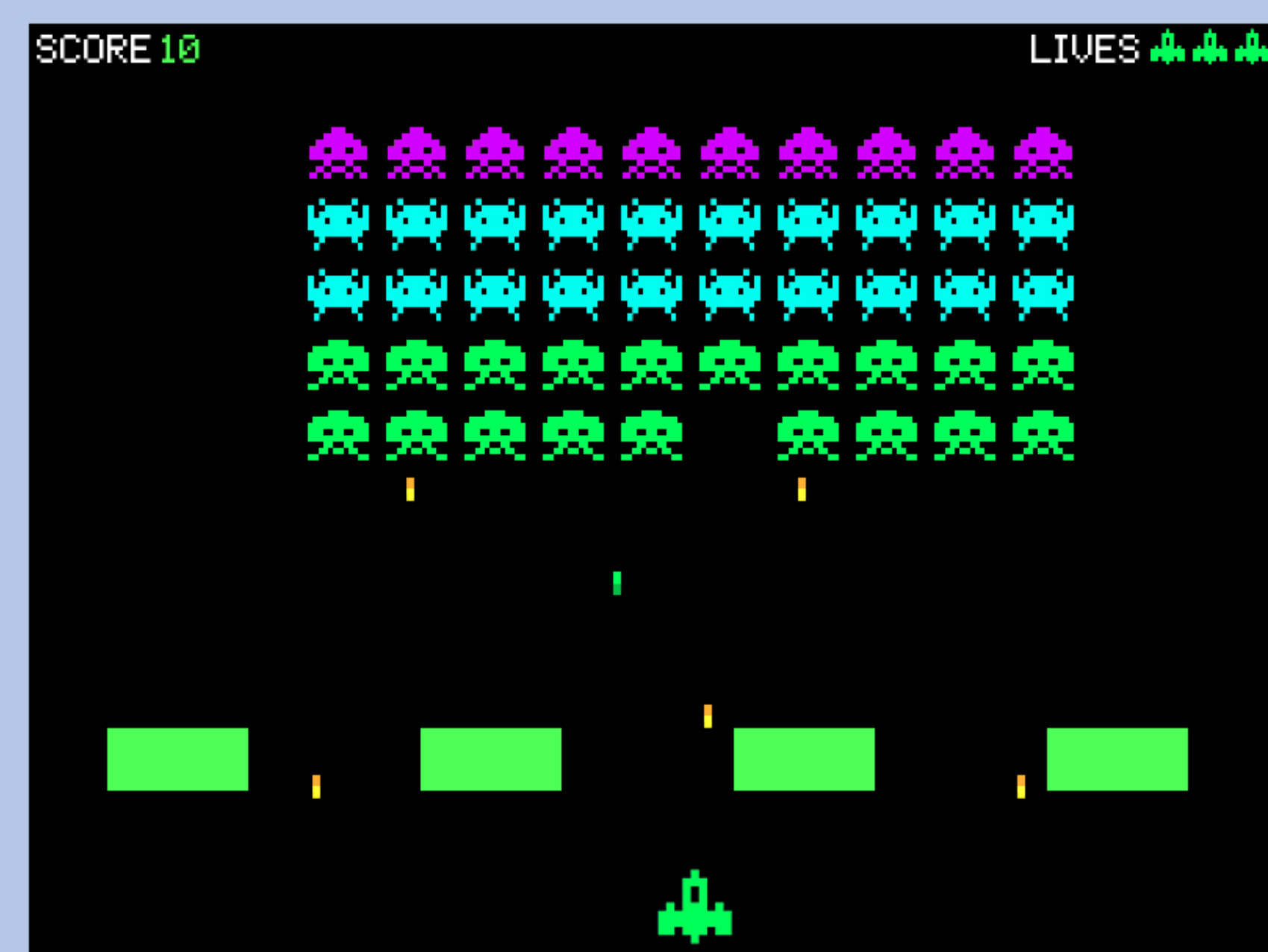
Vision guided Categorization

Agents

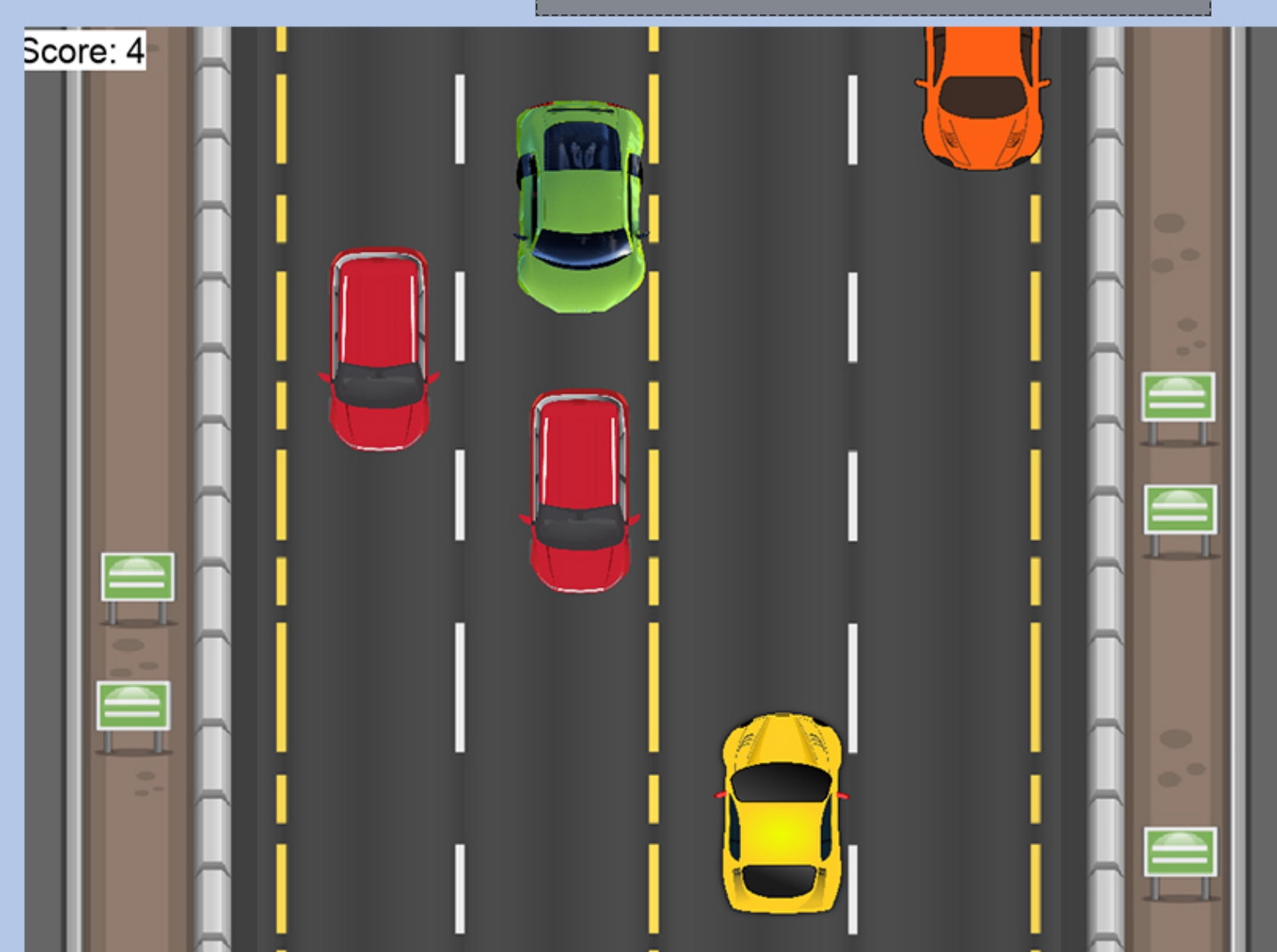
Causal Beings

Social Beings

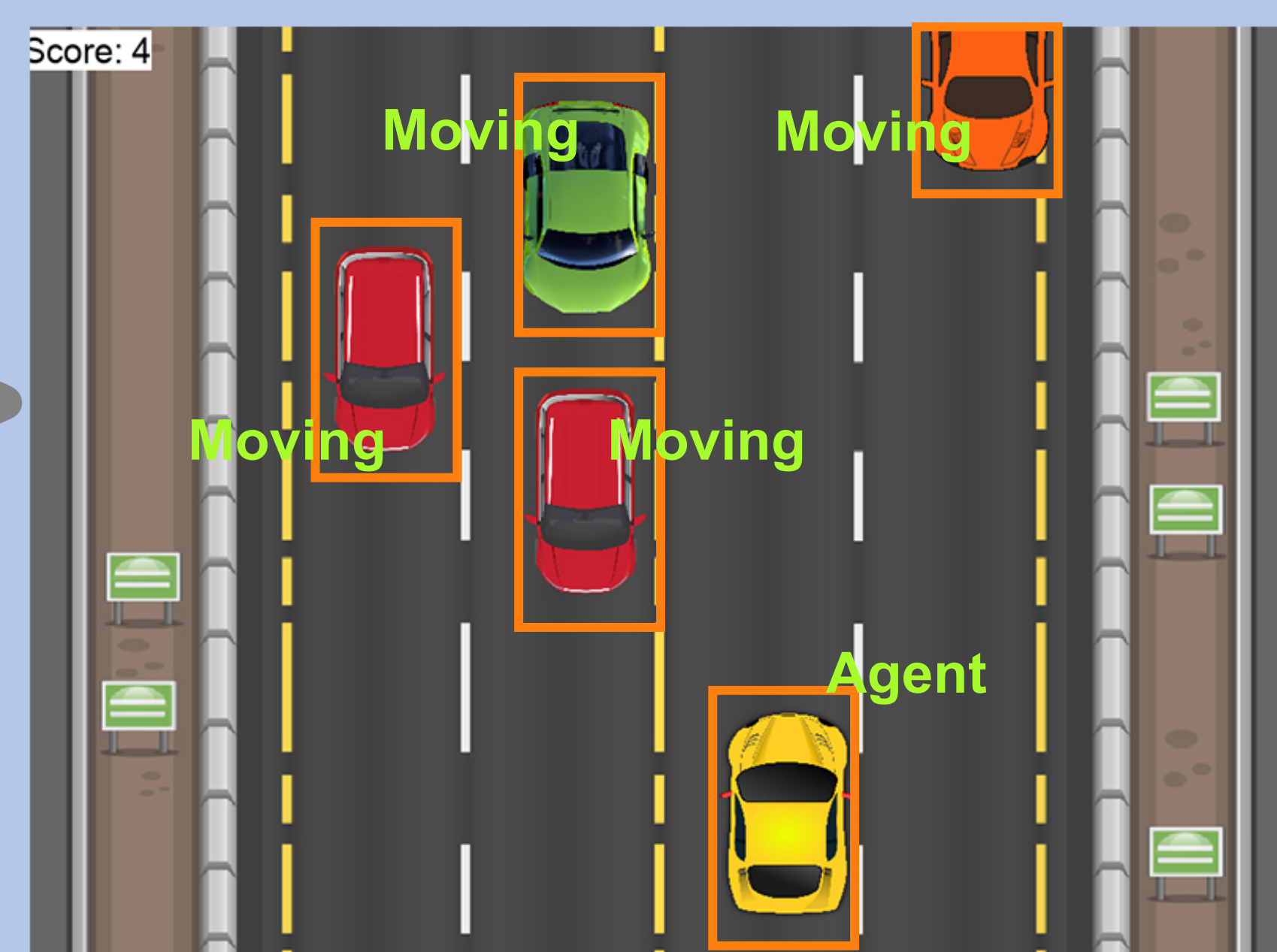
Experiential Transmission



What?: From Pixels to Objects



CNN Input: RGB Pixel Map

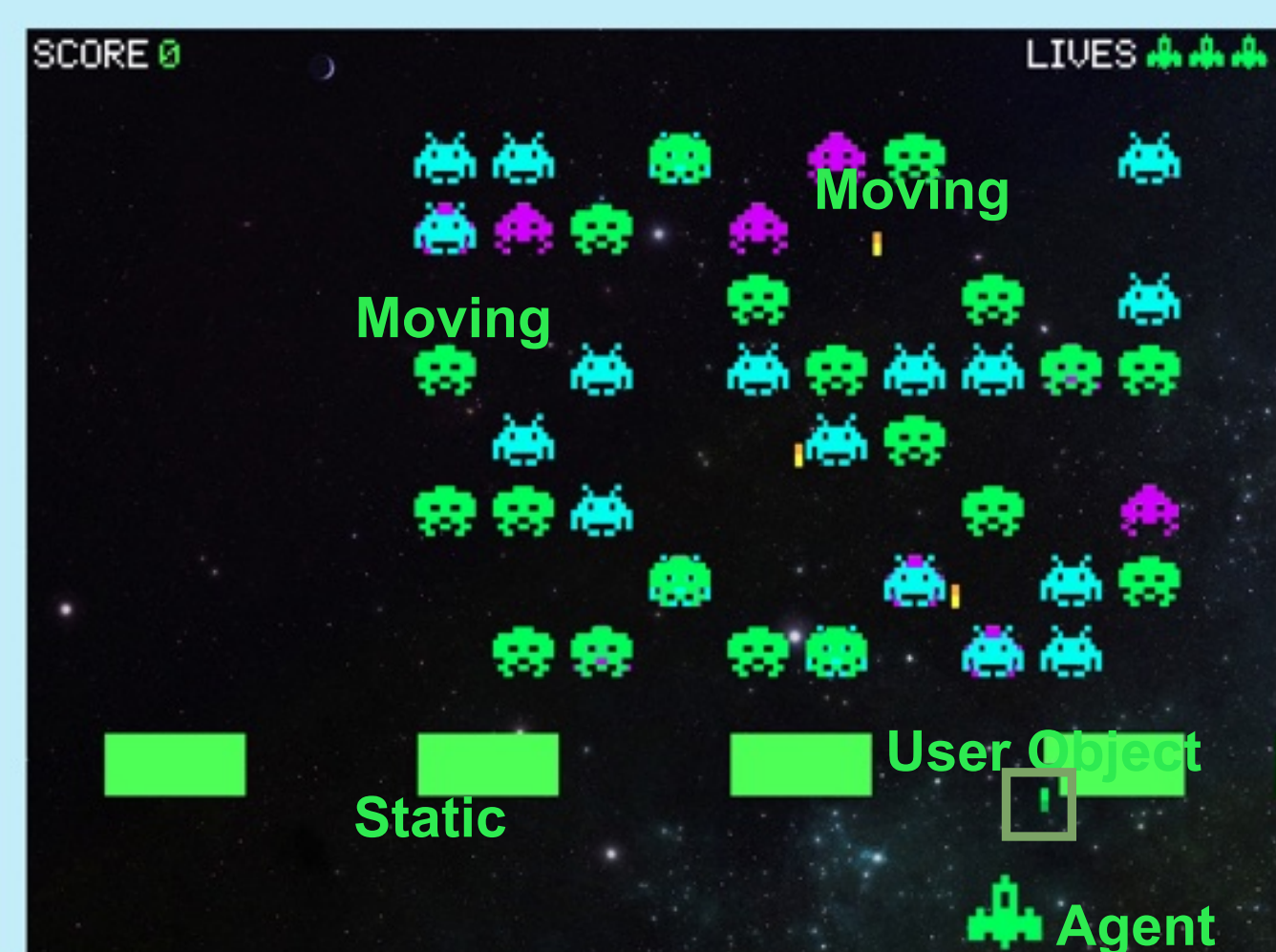


Preprocessed Input: Bounding Box Corners

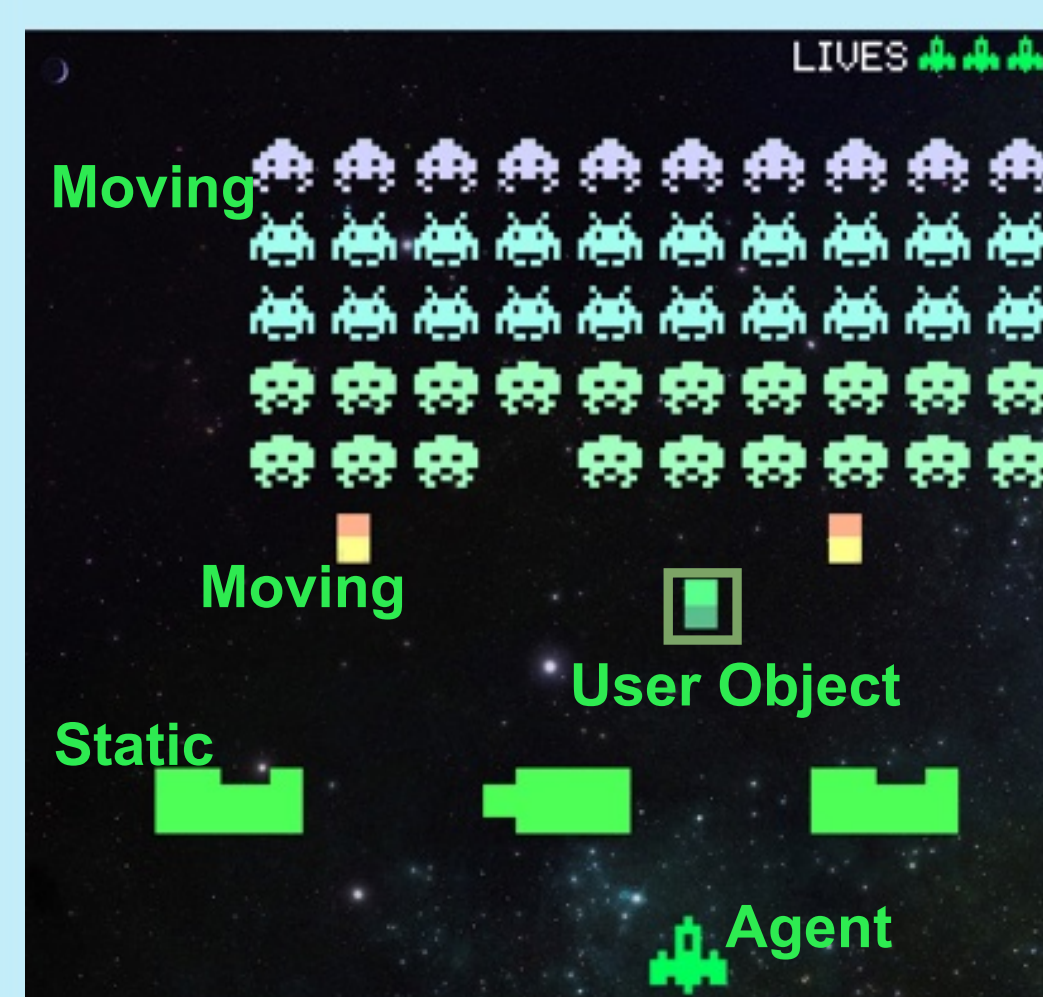
Why?:

Explainable Machine Output

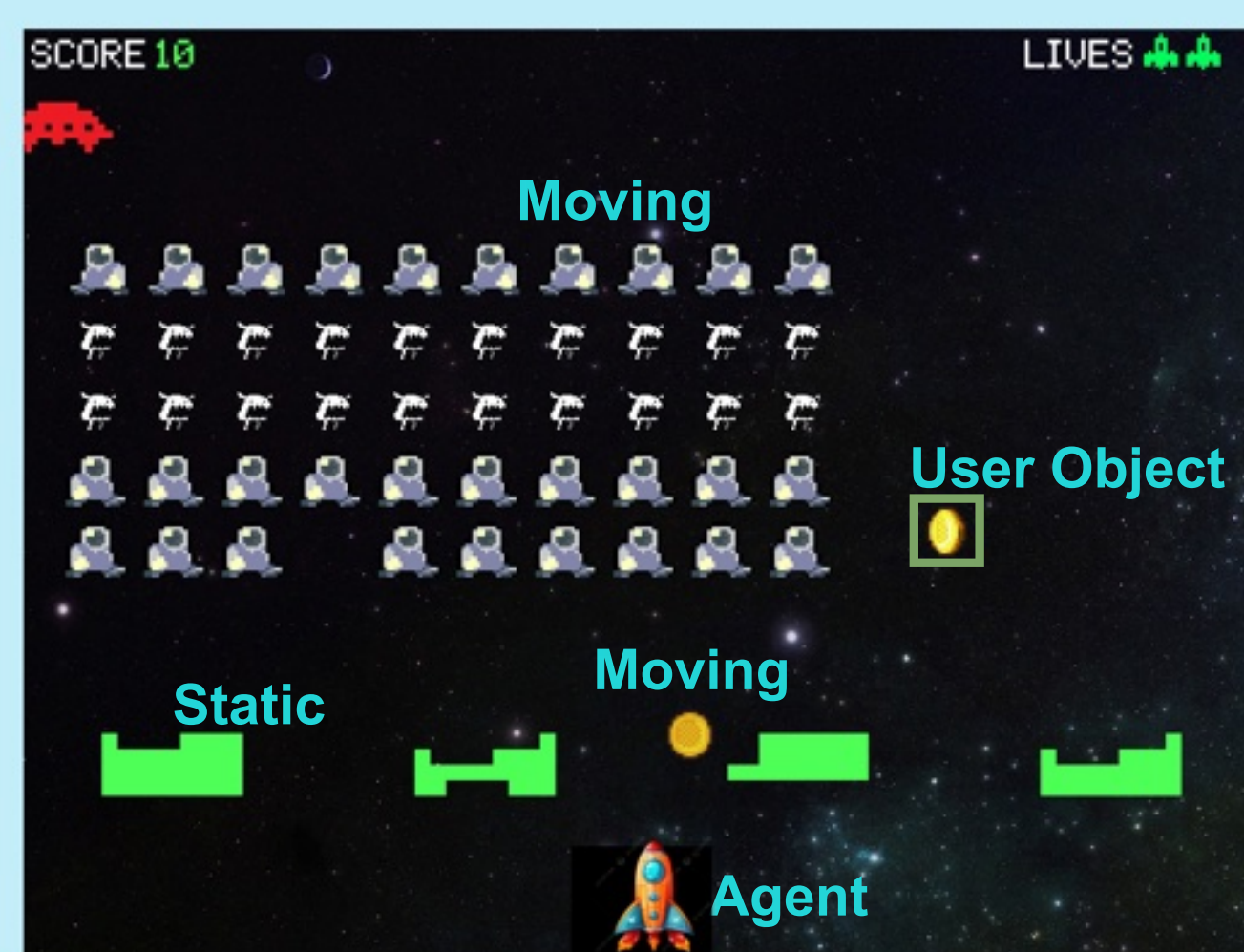
Leverage Similar Benefits as Humans



Mod-Position



Mod-ColorSize



Mod-Image

Deviations	Humans	DQN-DeepRL
Variants	Plays Well	Scores drops
Sample Utility	High	Low
Skill Transfer	Quick	Struggles

How

Affordance Based Object Categories

- Agency
- Agent spawned Objects
- Static Objects
- Moving Goods
- Moving Bads

+

State



AGENCY – Who am I on the screen

Uniqueness

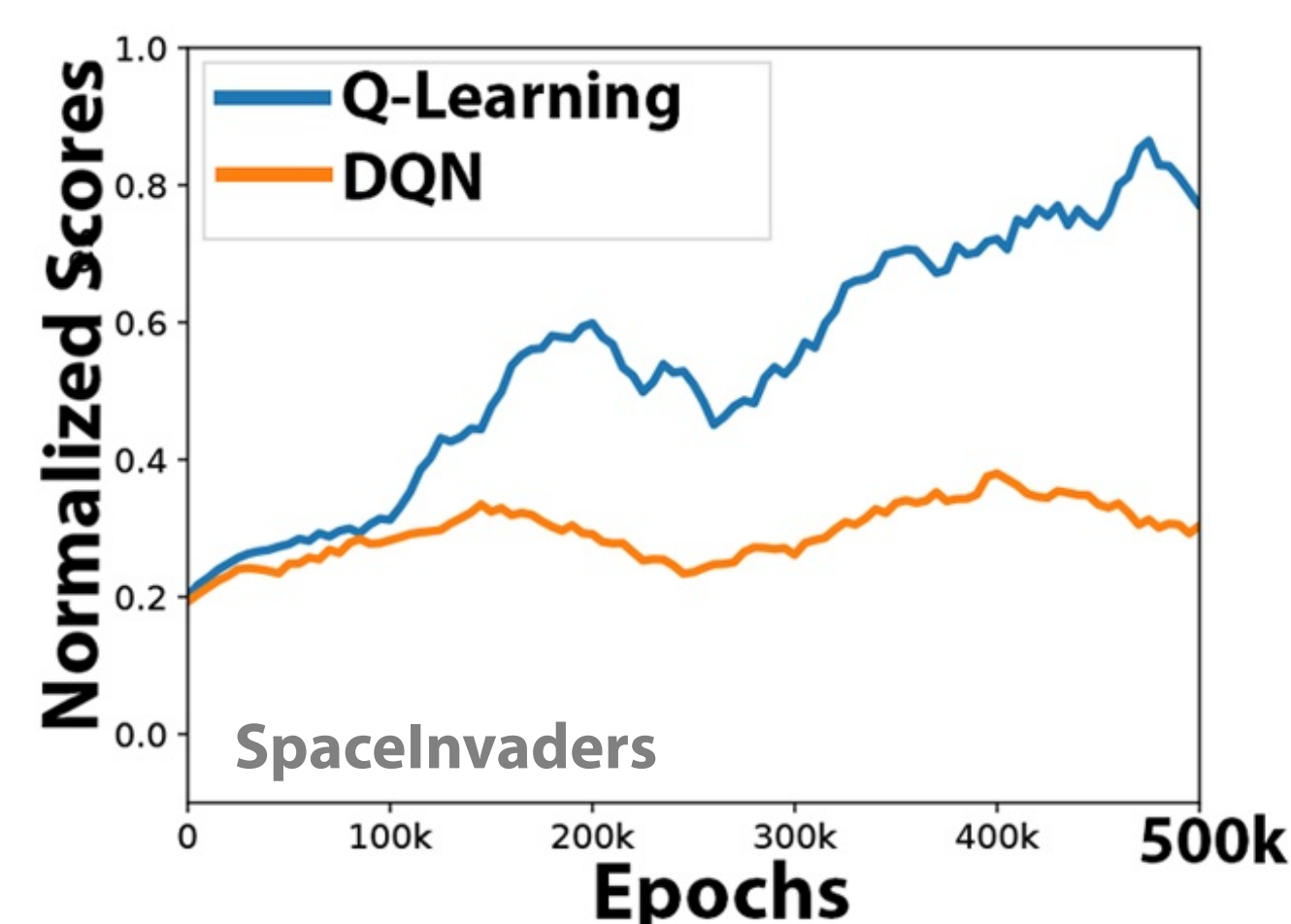
Permanence

Action Object
Motion Binding

Next??

Let's Discuss Possible Extensions?
Any Pointers for Postdoc?

Results



Normalized Game Scores vs Epochs

Modifications

RandomPlay

Base Variant

Mod-Position

Mod-ColorSize

Mod-Image

SpaceInvaders

DQN Ours

0.27

0.51 1.0

0.28 0.42

0.31 1.0

0.30 1.0

Normalized Scores for Game Variants

References

- What Babies Know: Core Knowledge and Composition Volume 1 by Elizabeth Spelke .
- Human-Level Reinforcement Learning through Theory-Based Modeling, Exploration, and Planning.
- Other works by Dr. Joshua Tenenbaum and group.