

Prediction Games in Infinitely Rich Worlds

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Categories are fundamental to intelligence [Mur02, Tha05, LJ99]. Without categories, every experience would be new, and one couldn't make sense of one's world. Furthermore, higher intelligence requires large numbers of categories, perhaps millions and beyond. Acquiring and robust detection of categories appears to be a complex task as categories inter-relate in complex ways and occur in diverse conditions. We may then ask: *how can a system learn so many complex inter-related categories?*

We propose and explore an avenue that we call *prediction games in infinitely rich worlds*. In these games, the world is a source of an unlimited stream of information. The games are played by a *prediction system* that in effect repeatedly experiments with its world and learns from its experiments. The system converts its input stream from the world into a sequence of learning episodes for itself. Each learning episode consists of the system hiding parts of the input, guessing (predicting) them using the remainder of the input (the local context), and updating itself based on comparing its observations with its predictions. The goal of the system is to improve its predictions, as we describe.

The games enjoy two general properties that we want to emphasize:

- Ample learning opportunity is available, and there is much to learn.
- The world, while complex, is rich in regularities that make efficient scalable learning possible.

Abundant learning experience is a necessity for learning millions of richly interacting categories. Furthermore, we argue how the goal of improving predictions may drive the learning of various kinds. In the course of playing predictions games, the system should acquire myriad new categories to be predicted and to help predict. We discuss the many aspects of the games, desiderata on solution algorithms and systems, and the challenges that we anticipate [Mad06]. We report on preliminary results on a prediction that plays the prediction game on large text corpora. After millions of learning episodes, the system learns tens of thousands of new categories.

References

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