Intuitive physics engine in human and AI

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1   Introduction

Intuitive physics engine is a rule-based model that explains and predicts the physical phenomenons in the real world. However, most times we understand the physical scenes quickly and not very precisely. It seems that we don't use physics engine for understanding and reasoning in real world.It is discussed that whether humans have intuitive physics engine. Moreover, if AI can reason and learn from some physical phenomenons, how can the AI learn to acquire common sense and reasoning? This essay tries to discuss the intuitive physics engine in human and AI. In my perspective, humans also have intuitive physics engine. And AI can simulate this kind of physical model for reasoning.

2   Human common sense

Starting with the recognitive way we humans use, we always understand the physical scene in a rapid way. It seems that physical scene understanding is a natural behaviour of humans. When we are asked to tell the reason that we understand the physical scene, we sometimes can not tell the rigorous reasoning process. The features that we humans understand the physical scenes are obvious: fast, intuitive, imprecise, cost-little.

Despite the features above, humans also use some rules and casual links to reason. For example, when they are watching a magic show, they may be surprised by the magical visual effect. But they will believe firmly that the magic show is some tricks and not true. Because they know the physical rules in real world can't be changed.

Based on these facts, I think humans have intuitive physics engine. In terms of the construction of the engine, it may not be very clear now. But we can tell it by some examples. In the figure 1 below, the question is which ball is heavier.

For humans, this question is not so difficult. After observing the balls' movements, we can tell that Ball A is heavier in the top four scenes, and Ball B is heavier in the down four scenes. So how do we get this result? I
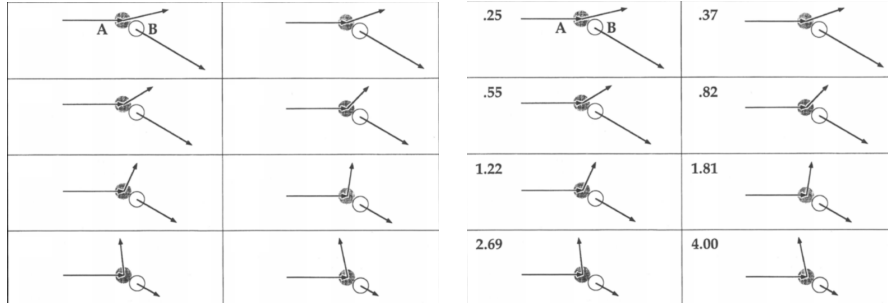
Figure 1: Test: which ball is heavier

think we judge the scenes through both our experiences and physical rules in our knowledge. The former can also be called common sense. Although we may not experience the same scene as the test, we must have seen many similar scenes. Because we are very familiar with the collision in real life, we all know that the lighter thing will be knocked out further. That's why we always keep far away from the heavy moving things in real world. Back to the test, we can tell which ball is heavier because we know what will happen under normal circumstances.

3   physical rules for reasoning

In the test above, we also use some physical rules for reasoning. For example, we know that heavier thing has larger inertia. This makes it hard to change the movement. On the contrary, the light thing has little inertia, thus being easier to change the way it moves. So we can predict the ways of the heavy ball and the light ball after the collision. And when we obverse the movements of them, we can find the truth that conforms to our prediction.

The physical rules are important in understanding the physical scenes because sometimes the experience will blind us to the truth. When we are watching a magic show, we are surprised by the magical performance we see. These phenomenons are out of our common sense. So we should use our knowledge to reason and judge. For example, in a magic show the performer makes a coin disappear from his hand. But we know that coins and any objects can't disappear without any trace. So we can infer that the coin is hiden in the performer's hand or somewhere. That's the reason why we will never believe the magic show is true.

4   conclusion

In this essay I proposed a intuitive physics engine in humans. The construction of this engine may be complex. But it is based on both common sense

and physical rules we know. On the one hand, we understand the physical scenes with the help of our common sense. On the other hand, we make some reasoning precess by our knowledge. For AI, this kind of physical engine is also available if possible. It can learn from many real world facts to get the common sense. At the same time, it can reason by the physical rules we tell it.

References

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