AGI: PROTOTYPE

COMPROMISE BETWEEN SIMPLICITY AND COGENCY

Mykola Rabchevskiy
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When developing a prototype, it becomes necessary to find a compromise between its simplicity of development and convincing viewers that the approach works. This chapter describes a variant of this tradeoff for the AGI prototype based on the previously described solutions: AGI engineering.

The convincing demonstration of the approach requires implementing the prototype of those requirements, without which an intelligent system cannot be qualified as AGI.

The main requirement is the ability to ***autonomously and permanently learn***, using one's ***own experience*** of actions, starting with a ***minimum amount of predetermined knowledge*** about the environment; as a rule, specialized intelligent systems referred to as narrow AI do not have this ability.

The detailing of this requirement implies the ability to ***find cause-and-effect relationships***, ***detect previously unknown objects*** in the functioning environment, and thus ***create new concepts***. Of course, the AGI prototype must demonstrate the ability to intelligently ***change goal-oriented behavior depending on the prevailing situation***.

The environment in which the prototype operates must be pretty ***general***. This means correcting the system's behavior. Therefore, the prototype must have a human-machine interface (HMI) capable of communicating in a formal language comfortable enough for human use.

The mission performed by the prototype, on the one hand, should not be trivial; on the other hand, the actions of the tested prototype should be easily interpretable so that a non-professional can assess the degree of rationality/adequacy of activity.

It is possible to use the ***natural environment*** and the ***embodied*** prototype, but replicating the system and experimenting, in this case, is associated with practical difficulties and is very expensive, so this option was rejected as unacceptable at the initial stage - although it can be beneficial in the following steps.

The prototype and virtual environment should be ***lightweight*** enough to be used on a ***typical modern desktop/notebook***.

What is not necessary for a prototype? From our point of view, there is no need for realistic visualization of the virtual environment and detailed physical modeling of three-dimensional objects of the environment. Consuming a lot of computational resources, such models remain, in fact, primitive (not very realistic) if the previous requirement is followed. Clarity of the situation and the process can be provided by ***two-dimensional visualization*** in the style of a ***dynamic map/scheme***.

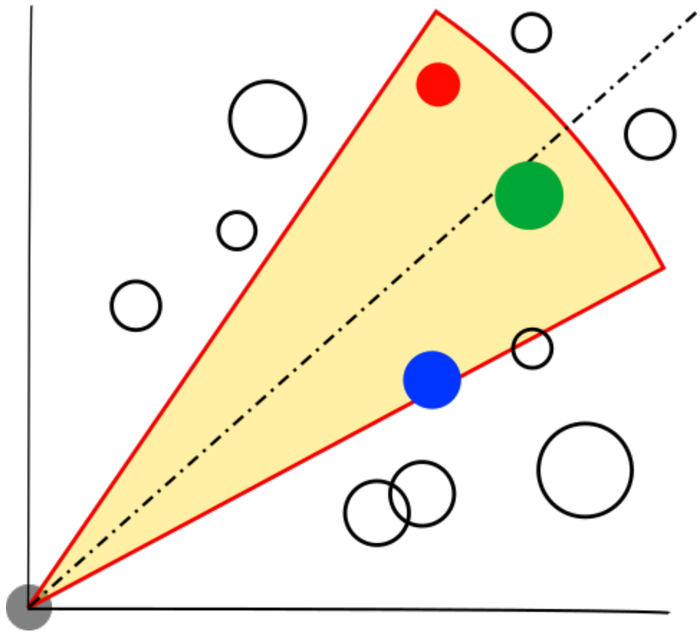
A variant of the test environment and mission that satisfies the listed conditions can be a ***virtual robot-porter (robot-sherpa) in a crowded environment***, following its master; it is required to ***avoid collisions*** with people and stationary objects, ***keeping the distance*** within an acceptable range.

For simplicity, objects can be modeled with circles of different diameters in an infinite two-dimensional space. In addition to size, objects have one more quantitative parameter perceived by the robot's sensors (for example, color). The trajectories of moving obstacles, the host object, and the coordinates of motionless obstacles are generated randomly. For simplicity of modeling the environment, collisions of moving objects with each other and collisions of moving objects with static obstacles are ignored, in contrast to collisions of the controlled robot with any objects. A ***clash*** of a robot with another object will ***stop*** the robot, and if such object moves, it will also stop.

Moving objects can form a ***composite object*** - a ***pair in which the distance between objects is constant***; the robot should ***avoid walking between the elements*** of such a compound object.

The virtual robot is equipped with the following ***sensors***:

- A sensor that ***detects a collision*** with something or the crossing the gap between the elements of a composite object.
- The spatial testing sensor reports the ***coordinates and parameters of each of the objects within the sector of view***, the distance to which is less than the "***horizon of visibility***"; the orientation of the tested sector defined in the command/request.
- The position sensor reports ***orientation and position of the robot*** on request.
- The sensor of the ***master position***, reporting coordinates (including at a distance exceeding the horizon of visibility).



Virtual ***actuators*** correspond to the widely used ***tank steering chassis***, in which movement and turns are carried out by separately controlling the left and right wheels (or tracks).

The ***average speed of the wheels*** determines the ***speed of movement***, and the ***difference*** in their velocities determines the ***rate of turning*** left/right. The command parameters are ***acceleration*** for each wheel; ***zero acceleration*** corresponds to moving at a ***constant speed*** in a straight line, in a circle, or rotating in place. The specified accelerations ***remain constant until the following command***, except when the velocity reaches the maximum allowable value: the acceleration is ***set to zero***, and the velocity stops changing.

The essential aspect of AGI is ***how much preloaded (congenital) knowledge is required*** for the system to be able to autonomously learn to act rationally. In the described variant, ***congenital*** knowledge includes the following information:

- Description of ***attributes used in messages/data received from sensors***.
- Definition of ***atomic functions-relations*** between attributes used in finding composite objects (see Structures discovering)
- ***Sensors description***
- ***Actuators description***

The ***mission*** of the system is determined by the ***parameters of the motivation module***, which determine the ***criterion function*** for assessing the ***situation***, taking into account the negative impact of ***collisions***, the positive effect of the case when the ***distance to the master*** is within the acceptable range of values and the negative impact of going beyond.

In the process of "***life***," the system must acting ***autonomously*** and demonstrate the following abilities:

- ***Learn to predict collisions*** by detecting a ***causal relationship between the distance to the object and the signal from the collision sensor***
- Recognize ***existence unknown previously composite objects*** and ***create new concepts*** that define their
- ***Learn to predict collisions with composite objects***
- ***Learn to move while avoiding collisions***
- ***Learn to follow the master***, avoiding collisions and ***keeping the distance to him***, if possible, within the given limits.

The ***degree of complexity of the mission*** can be changed by changing the ***average number of objects in the visibility zone***, the ***complexity of the trajectories of the objects***, and the ***speed*** of their movement.

Technologically, the prototype should include components of the ***environment model***, ***AGI module***, and a ***real-time situation visualization*** system. The situation visualization system should ***separately display the situation in the environment and its internal representation***, allowing the process to be assessed by comparing one with the other. The operator can ***pause the simulation*** process and use the pause for ***introspection of the accumulated information***.

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Brett Martensen Oct 4 Liked by Mykola Rabchevskiy

In the following paper, Barto et al. described a rather interesting test environment that could be used for an AGI prototype. I thought you might be interested.

Barto, A. G., Singh, S, and Chentanez, N. 2004. Intrinsically Motivated Learning of Hierarchical Collections of Skills. in Proceedings of the 3rd International Conference on Developmental Learning (ICDL ’04)., LaJolla, CA, 112–119.

It is at: http://all.cs.umass.edu/pubs/2004/barto_sc_ICDL04.pdf

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