AGI engineering

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AGI IN A WORLD OF TRAJECTORIES

HOW CONTINUITY AFFECTS AGI DESIGN

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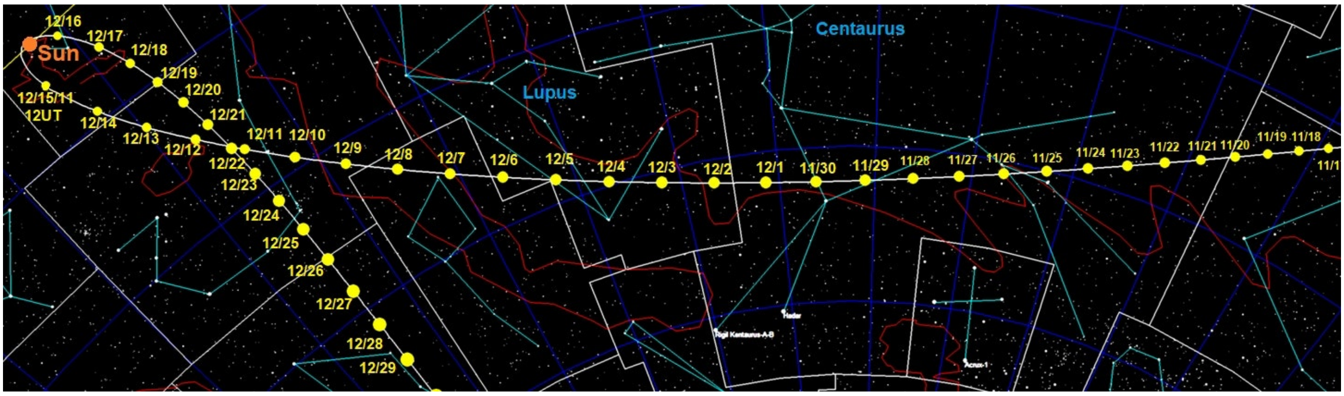

As noted earlier, the ***continuity of the environment*** significantly changes the requirements for the AGI implementation. This chapter analyzes in more detail the specificity of AGI caused by the continuity of the environment.

In a discrete environment, the current situation is fully described by a sequence of past events (the contents of the Chronicle). An elementary change in the environment is adding a new event to the Chronicle; in the interval between events, the situation remains unchanged.

The continuous environment contains a set of objects, the parameters of which events are ***tied to the forecasted moment*** of occurrence of the event (which is not the case in a discrete environment). The presence of the moment of a future event allows, in turn, to construct a ***forecast of the sequence of events***.

Along with events caused by the interaction of objects in the environment, discrete events can also occur (a new object was detected in the environment, the light went out, the electricity went out, and so on).

Actions initiated by the system, in the general case, can also be both discrete actions-events and ***continuous processes with start and end events, with time-varying parameters*** (for example, moving from a current point in space to a given point along a particular trajectory).

The continuity of the environment means that the current situation is described by the parameters of the environment objects, the values of which change over time. Accordingly, the chain of inherently discrete events in a continuous environment does not fully describe the current situation - ***not only in the time intervals between events but also at the moment of the event***. The logical context, determined by the sequence of previous events, should be ***extended by the description of continuous processes*** that define the processes in the environment in the intervals between events. This makes it possible to construct a ***forecast of changes in the situation in the environment*** and predict future events on this basis.

In the case of a discrete environment, only past events are the source of forecasting events. In a continuous environment, the chain of preceding events is still used, but differently. Past events determine the ***set of objects*** in the environment (the appearance and disappearance of an object are events) and their ***type*** (the identification of an object is also an event). Object types, in turn, are used to predict their behavior and predict events.

The type of an environmental object is determined by its semantic description, that is, a syndrome (set of features), which may not include a physical type (person, car, tree, etc.), but include characteristics inherent in any environmental object: size (large, small), speed (fast, slow, stationary), the degree of danger, and so on. Some of the features mentioned are directly related to values measured by sensors or calculated from data from sensors in a predetermined manner; the associated concepts are obviously "***congenital***," and the set of such concepts is dictated by the available set of sensors and the mission of the system. The procedures for assigning the corresponding features based on the values measured by the sensors are also predefined. The signs that characterize the behavior of environmental objects (for example, dangerous/safe) can be assigned differently - based on the accumulated experience.

Updating the environment model is a permanent process that step by step details information about each detected object, providing more and more accurate ***classification*** (object -> moving object -> fast-moving object -> car) and ***combining several identified objects into a more complex composite object*** (car + something moving with it -> a vehicle with a trailer). The update is based on data from sensors (coordinates, speed, and other quantitative parameters) received at the request of the update module.

To implement the described operations, it is necessary to operate with the ***trajectories*** of objects; that is, Data Storage must store information about the trajectories (the dependence of parameters on time). The analysis/forecasting module must contain the ***functions of operating with trajectories***. The ability to ***compare trajectories*** is necessary to classify objects and identify them, considering the observed trajectory (accordingly, a trajectory is a kind of object behavior). Naturally, it is essential to implement the ***construction of the trajectory from successive measurements*** of coordinates and its permanent updating. The update rate of the dynamic model is determined by the attention module.

The following can be used as test missions in a natural two-dimensional continuous environment:

- ***delivery robot in a crowded square during public events***
- ***control of ship entry into a port with heavy traffic***
- ***guard boat on a crowded beach***

The goal in all cases is to quickly reach a given point, avoiding collisions with other objects (people, stationary obstacles, other robots, ships).

The simplest composite objects are groups of people moving together or bundles of a tug and a towed vessel (a boat towing a water skier). In both cases, the controlled object should not try to pass between the group objects.

Smart sensors provide a list of objects and their current coordinates within the requested view sector and, possibly, some additional information depending on the mission.

← Previous

Next →