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EDITOR'S COLUMN

What's Next After Big Models? Small Models? Agents? Other Things?

The last couple of years have seen a steady stream of bigger and better big models. But what's next after the current high-water mark—big models? Small models? Agents? Or other things? In intelligent transportation systems, the same question stands. What's next after big transportation models? Another wave of small transportation models? Agents in real and virtual worlds? Or something else?

Here, I would like to quote a Chinese proverb to answer this question. Whenever we learn something, it is important for us to “internalize in heart, externalize in action.” If big transportation models are compared to “human brains,” they have the abilities to perceive, cognize, reason, make decisions, and learn in a broad sense, that is, “internalize in heart.” However, this is only the foundation. The cognition of big transportation models needs to be transformed into actions, verified in practice in both the physical and virtual worlds, that is, “externalized in actions,” to achieve “unity of knowledge and action.” Therefore, those technologies that can integrate knowledge and action could be our next hot topic.

Agents are likely to realize “unity of knowledge and action” by integrating perception, cognition, decision making, and learning—and doing it smoothly. Technically, agents could be “virtual people” or “digital people” wandering in the virtual world, or physical robots traveling across the physical world. Of course, before traveling in both worlds, the “brains” of virtual agents and physical agents should be distilled or produced from big models and then trained and developed in both worlds.

With the breathless and overwhelming pace of innovation, agents (virtual and physical) and humans are likely to form an inseparable “unity,” in which humans are the leaders and owners of agents, while agents are followers, interacting with humans at the task level through natural language or brain-computer interfaces, executing human commands and fulfilling human wishes. Through cooperative learning in two worlds, the abilities and knowledge of humans and agents will be mutually enhanced in a timely fashion by sharing the same thoughts and aiming at the same goals, which is bit like the “Trinity” in the Bible: “Three in One.” However, in “unity,” “three” refers to three physical forms, including carbon-based life forms, silicon-based forms, and composite life forms, while “one” means the integration of three kinds of intelligence, such as computational intelligence, embodied intelligence, and biological intelligence.

“One person is a team” will no longer be an exaggeration in the literary sense but will luckily become true in the future. In the days to come, we can imagine that the new “trinity” or “unity” might become the basic unit of social organization and operation, and it might take the world by storm by greatly improving efficiency of organization, learning, and operation. In terms of the human-machine division of labor, humans mainly take care of proposing goals, decomposing tasks, and, most importantly, dividing work, not only between humans and machines but also between the virtual world and the real

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world, while agents mainly handle task execution, real-time feedback, and obsessive 24-h learning. Of course, that’s only a glimpse of the future, promising world yet to come; we can expect more.

In intelligent driving scenarios, members in a “unity” will complete driving and other tasks together. Virtual agents (virtual cars) will upgrade driving and other skills in various scenarios in virtual worlds and migrate to physical agents (unmanned vehicles) with or without owner permissions. Unmanned vehicles will independently, or by assisting owners, complete driving and other tasks and upload various scenes from the real world to the virtual world, gradually narrowing the gaps between the virtual and real worlds. As leaders and owners, humans are ultimately responsible for driving behaviors, tasks such as picking destinations, choosing travel plans, selecting driving modes [semi-automatic, automatic, semiautonomous, autonomous (yet to come)], and dealing with emergencies. In the autonomous driving mode (yet to come), unmanned vehicles will truly become mobile platforms for work and life.

Perhaps one day, after extensive crucial training in complex driving environments, unmanned vehicles will generate a series of flexible response mechanisms, automatically completing a series of tasks, which can be called “autonomous” behavior in a broad sense. For example, to achieve an owner’s economic goals, a vehicle may make money by delivering people or goods in leisure time, or when the owner feels sad, the vehicle could switch to a pacifying mode by playing soothing music, ordering the owner’s favorite gifts,

or even picking up the owner’s best friends to come along for the ride. By then, autonomous transportation systems might truly exist, and vehicles will not only be a means of transportation, but also life companions and work colleagues.

By now, after witnessing trends from mechanical to automatic, then to autonomous, and so on, I can’t help but ask: What is the purpose and final end of this trend? As the old saying goes, “Our life is a process of being, knowing, and doing,” which might be secured by a new “trinity” all the

way around. Probably (and one hopes), during this whole process, humans could “understand the vastness of nature” and “know the wisdom of life,” to “have self-knowledge and achieve promising things.”

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