Market logic

A small company develops artificial intelligence software to control industrial production

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A small company founded just six years ago has been able to attract clients as important as Coca-Cola, Rhodia, Villares and Ajinomoto by developing an algorithm based on fuzzy logic knowledge. Fuzzy logic is an area of artificial intelligence research related to the expansion of set theory that addresses, for example, whether elements belong to a particular group. "In this approach, something can be partially contained in a system," says computer engineer Igor Santiago, executive director of I.Systems, which is headquartered in Campinas (SP). "That is, a person is neither tall nor short, but 80% tall, for example. This differentiation results in a very large number of practical applications that were previously impossible using classical logic." In classical binary logic, the result can only be yes or no, right or wrong. In practice, the electronic system created by I.Systems reduces losses and makes industrial processes and equipment more efficient. These include machines for packaging liquids or powders, steam boilers, distillation towers, power generation from biomass and sewage treatment. The software, called Leaf, automatically generates thousands of rules using fuzzy logic to ensure the stability of the industrial control process.

Fuzzy logic is used for handling modes of reasoning that are approximate rather than exact. "It is used for developing intelligent systems that make use of imprecise or vague knowledge in decision making," explains electrical engineer Ricardo Gudwin, professor at the School of Electrical and Computer Engineering of the University of Campinas (Unicamp). "Today, fuzzy logic has a large number of applications, from focus control in video cameras to industrial controllers, elevators and robots, for example." The difference between the controllers currently on the market and the one developed by I.Systems is that in the latter fuzzy rules are created automatically, using an algorithm that the company developed. "This enables laypeople to quickly generate complex industrial control systems, resulting in substantial operational gains such as cost reductions and productivity increases," says Santiago says.

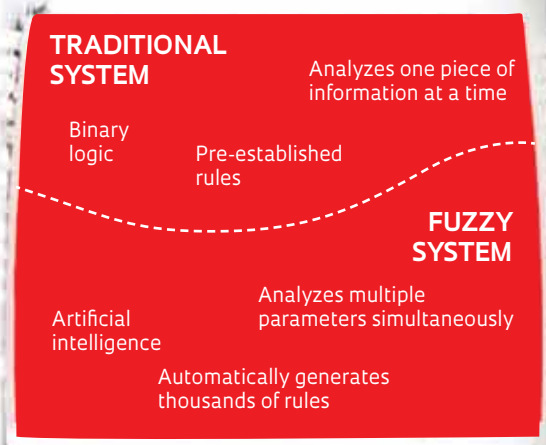
FAST READING

According to the businessman, who was aAccording to Santiago, who was a master's student under Gudwin, Leaf represents an advance of approximately 100 years over the technological process known as Proportional, Integral and Derivative (PID), which was created in the late nineteenth century and is still used today in nearly all automated manufacturing systems. He explains that PID technology was designed to read only one parameter at a time, such as temperature, pressure, or flow, to be used in planning how pumps, valves, and other equipment should operate so that production proceeds as desired. Santiago explains, "The fact that PID monitors only one parameter at a time means that it always has to wait for a problem to happen before it can react and try to fix it." By contrast, Leaf can monitor several parameters simultaneously. It can anticipate changes and prevent them from affecting production. An example can be seen in systems for filling bottles with a precise volume of liquid. Because of fluctuations of liquid in bottling systems, it is very difficult to fill bottles with the exact amount noted on the label. To circumvent this problem, companies regulate their filling machines to add 5% more liquid to ensure that oscillations do not leave the bottles with less than what is promised. Leaf, however, creates and implements fuzzy rules that reduce variations and make it possible to regulate the machines to inject only 1% more than the liquid promised, saving 4% of the volume of each bottle.

Leaf was implemented in 2010 at the Coca-Cola plant in Jundiaí, 60 kilometers

LÉO RAMOS

Profound differences



from the capital of São Paulo. The Jundiaí plant is the largest bottler of the brand in Latin America, producing 2 billion bottles per year. The challenge is to constantly control the internal pressure and the volume of soft drink inside the filling equipment. The problem encountered by the plant was that one PID system was used to control volume and another was used to control pressure. Because each system was not informed of the other's actions – because they can monitor only one information stream at a time – they ended up interfering with each other.

The solution was to implement the Fuzzy Multivariable Control program, which simultaneously controls pressure and flow valves on the bottling line, enabling finer and more precise adjustments to the quantity and speed of liquid injected into the bottles. "We stabilized the process of filling soft drink bottles, and the company has been saving 500,000 liters of soft drink and 100,000 PET bottles per year since 2010," Santiago says. "We managed to reduce losses from rejection due to variations in the level of injected liquid by 31% and rejections due to bubbling, which is the formation of bubbles of carbon dioxide, by 42%. Waste due to bubbling was reduced from 64 to 37 liters of soft drink per hour, and rejections due to liquid level dropped from 685 to 465 bottles per day."

The story that led to the formation of I.Systems began in 2004, when three computer engineers and a mathematician decided to take a course in artificial intelligence offered at Unicamp. That was when they started the research that led to the development of Leaf. The first business plan was written in 2006 as the final report for a course on entrepreneurship. They founded the company in the following year. In 2009, I.Systems secured financing through the FAPESP Innovative Research in Small Businesses Program (Pipe). "We used the funds to develop a soft drink bottler simulator and convince the Coca-Cola plant manager that our solution would generate benefits," says Santiago. "In 2010, we got further Pipe funding and used the money to make our technology viable."

Earlier this year, the company received funds from the Pitanga investment fund, which specializes in investing in technology-based companies, provided by eight investors: biologist and Pitanga administrator Fernando Reinach; the founders of Natura, Guilherme Leal, Luiz Seabra and Pedro Passos; and Itaú Unibanco bankers Pedro Moreira Salles, Candido and Fernão Bracher, and Eduardo Vassimon. "The Pitanga fund decided to invest in I.Systems because the company developed a new way of using fuzzy logic in a process to regulate industrial automation. It's an innovative solution that exists nowhere else," Reinach explains. "Some companies provide industrial automation, but none have this kind of solution. In the case of I.Systems' product, the potential market is any factory in the world."

The Pitanga investment, whose value has not been disclosed, will be used to develop new products and increase the sales team. In Brazil, I.Systems does not yet have competitors, but at the global level it will face major companies such as Siemens and General Electric. Santiago says, "we are evaluating whether to apply for a patent for our technology in Brazil or abroad, or if it is better to rely on industrial secrets in markets in the United States, Asia and Europe. ■

Projects

1. *Control of industrial processes: An approach through computational intelligence* (Nº 2007/56398-1); **Grant Mechanism** Innovative Research in Small Businesses Program (Pipe); **Coord.** Igor Bittencourt Santiago/I.Systems; **Investment** R$10,592.26 (FAPESP).

2. Application of Hourus platform for industrial automation and equipment (Nº 2010/51286-3); **Grant Mechanism** Innovative Research in Small Businesses Program (Pipe); **Coord.** Igor Bittencourt Santiago / I.Systems; **Investment** R$95,888.22 and $1,210.71 (FAPESP).