Normative Systems to Quantitatively Assess Performance of Complex Systems

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The performance of complex socio-technical systems in the real world is hard to evaluate because of the abstract nature of the purposes these systems aim to achieve. In the case of Ambient Assisted Living systems, the performance could be characterized in terms of how supportive the system is.

Providing assistance is a very human trait and has deserved the research of areas such as psychology, sociology, nursing, or social work, to cite some. In psychology, the Self Determination Theory has many followers and has been used in several areas, like teaching or healthcare. One of the ideas that Self Determination Theory defends is the interest in being Autonomy Supportive. This concept refers to the intention of aiding someone without making this someone dependent on your aid. Transferring these ideas to the area of automated human assistance, it is possible to model these parameters and use them to characterize the behavior of a complex system that aims to assist a person.

It turns out that the concept autonomy supportive can be captured in part through the use of deontic normative systems, where there are rules that actors in the environment must conform to (obligations) or avoid (prohibitions). Failing your obligations or violating a prohibition may imply a punishment. These concepts are well defined in the computer science literature about normative systems and can be applied to characterize the behavior of systems too. The fulfillment of norms as well as violations can be measured. Then the initial problem of characterizing a system performance through the Autonomy Supportive concept, can be rephrased as the measurement of how many times the system failed to help you when you needed it (tolerated failure) and how many times the system helped you when it was not needed (interrupted success). Determining the Autonomy Supportive ideal becomes an issue of how many times a tolerated failure and interrupted success ought to happen. This has a great significance since it enables a quantitative assessment of such systems.

So far, its application has been limited to realistic 3D simulations of ambient assisted living situations referring to different devices trying to aid a patient. The application to larger scale systems involving many humans and many devices is a matter of defining the proper adaptation of these deontic normative systems approach. Norms are a promising approach for defining human behaviors. These norms encode the knowledge about the expected behavior of the system and pose new challenges, like finding out when a norm is never going to be violated or if it is impossible to fulfill an obligation without breaking a prohibition. Advances are being made in this direction by means of the use of Colored Petri Nets formalization and Model Checking techniques.

To know more: Gomez-Sanz, Jorge J., and Pablo Campillo Sánchez. "Domain independent regulative norms for evaluating performance of assistive solutions." *Pervasive and Mobile Computing* 34 (2017): 79-90.