

: *How can ambient intelligence assist people in decision making?*

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Placing sensors and other computing devices in working and living spaces creates opportunities for real-time computer processing and faster, better informed decision making. In an **Ambient Intelligence (Aml)** environment people are surrounded by embedded devices that should merge unobtrusively and in natural ways with the surroundings. Using analytics, decision support and artificial intelligence (AI) enmeshed in a secure local area network connecting these devices, an Aml environment aids people in the environment. Internet of Things (IoT) devices with specialized capabilities work together to provide a variety of services, improve safety and the quality of life of people.

Ambient Intelligence is defined by the Advisory Group to the European Community's Information Society Technology Program (ISTAG) as "the convergence of ubiquitous computing, ubiquitous communication, and interfaces adapting to the user" (Gupta 2003).

An Ambient Intelligence (Aml) revolution is occurring. IoT technologies will be embedded in our cars, homes, grocery stores, offices, hospitals and transport. Working and living environments can be surrounded by networked, embedded devices that merge unobtrusively. Specialized devices will work together to provide decision support, decision automation, and other services that improve performance, safety, security and outcomes in ordinary living and working environments.

Our surroundings can be sensitive and responsive to our presence, actions and needs. An Aml environment can alert a person to choices that can or should be made. Decision support software in an Aml environment can provide recommendations, help in planning, and present data summaries that inform decision makers. For example, an Aml hospital room can provide data to the nurse in charge of a hospital ward, a patient's physician, and a hospital pharmacist.

Rapid adoption and implementation of digital technologies and artificial intelligence is occurring in many settings, i.e., manufacturing, hospitals, retail stores, warehouses, and homes. Digital devices are becoming more sophisticated, including smaller, less expensive sensors, improved voice monitoring and recognition, connected control devices. Progress and adoption of digital technologies seems to be speeding up at an exponential rate.

Ambient Intelligence is not a new vision, rather technology developments have expanded implementation possibilities. For example, one can now create a manufacturing environment that

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senses workers and their actions, collects data from machines and materials, monitors temperature, etc. Now ambient technologies can completely change how we support an aging population and help people live longer and more independently in their own homes. These visionary capabilities and others are becoming feasible. Creating the software to interpret, monitor, share, and act upon data from sensors in real-time will however continue to be a challenge. Appropriately involving human decision makers will also be an ongoing challenge.

Aml does have some serious ethical challenges. For many reasons, it is important for us to consider the ethical implications of using "hidden" intelligence to collect, process, analyse and share personal data. In a world where issues such as explicit consent for data and more broadly data security are of increasing concern, we need to examine Aml proposals on multiple levels, i.e., personal, organizational and societal. Such a broad stakeholder approach can help ensure that personal data is treated in a responsible, ethical and compliant way.

Some use the term Intelligent Environments (IEs) rather than Ambient Intelligence (Aml). IEs refer to physical spaces where IT and other pervasive computing technology are woven together seamlessly and used to achieve specific goals for the user, the components or the environment or both. IEs have the ultimate objective of enriching user experience, better manage the environment, and increase user awareness of the environment. Studying IEs or Amls is and must be a multidisciplinary, collaborative effort for researchers and practitioners from Computer Science, Electronic Engineering, Building Architecture, Business, Art and Design, Sociology, Government and Education.

In summary, Ambient Intelligence (Aml) refers to a data-intensive environment that senses changes in state and responds appropriately to correct, act or alert decision makers. The goal of a sensor rich Aml environment is stability and homeostasis. Also, ambient intelligence (Aml) refers to any digitized living and working environment that is designed with embedded technology and Artificial Intelligence to assist people. Ambient describes a physical space and its internal and external surroundings.

Ambient intelligence (Aml) is a vision for a pervasive computing environment that enables interaction with and appropriate responses to the people in that environment. Aml is an engineered, technology-enriched environment with sensors, decision support, analytics, machine actuators, machine learning, AI, and other capabilities connected together. Aml is much more than AI.

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