

Managing Knowledge for the Digital Firm

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Knowledge

- In an information economy, knowledge & core competencies are key organizational assets.
- Knowing how to do things effectively and efficiently in ways that other organizations cannot duplicate is a primary source of profit.

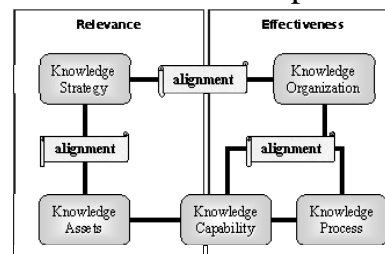


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Knowledge Management

- It is the process of systematically and actively managing and leveraging the stores of knowledge in an organization.
- Information System can play a valuable role in knowledge management, helping the organization optimize its flow of information and capture its knowledge base.



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Chief Knowledge Officer

- Some companies have knowledge management program for protecting and distributing knowledge resources that they have identified and for discovering new sources of knowledge.
- These programs are often headed by Chief Knowledge Officer (CKO)



Peter Engstrom
Chief Knowledge Officer,
SAIC



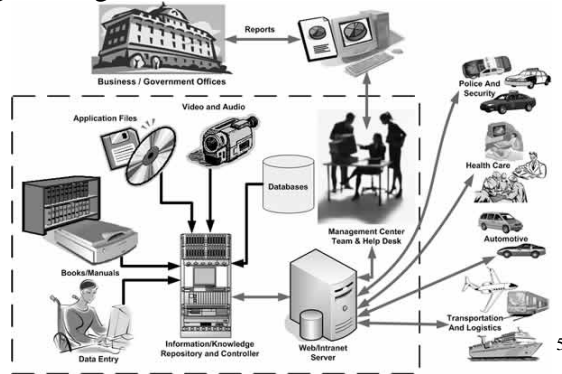
Nicolas Gorjestani
Chief Knowledge Officer,
The World Bank

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Information System for Knowledge Management

- Office Automation Systems (OAS), Knowledge Work Systems (KWS), Group Collaboration Systems, and Artificial Intelligence Applications are especially useful for Knowledge management.



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Knowledge Base

- Knowledge base may include:
 - Structured Internal Knowledge (e.g. product manuals or research report)
 - External Knowledge (e.g. competitive intelligence)
 - Informal Internal Knowledge (tacit knowledge) which is expertise and experience that has not been formally documented.

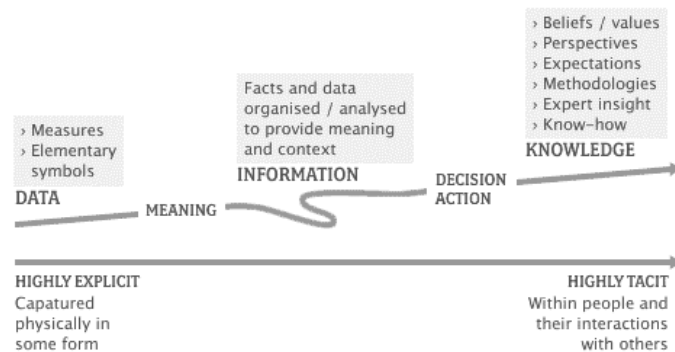
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Information Work

- Work that primarily consists of creating or processing information.

WHAT IS THE KNOWLEDGE ENVIRONMENT FOR CHANGE?



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Data Workers

- People such as secretaries or bookkeepers who *process and disseminate the organizations information and paperwork.*



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Knowledge Workers

- People such as engineers, scientists, or architects who design products or services or *create knowledge for the organization*.



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Office Automation Systems (OAS)

- Help disseminate & coordinate the flow of information in the organization.
 - ◆ Word Processing
 - ◆ Desktop Publishing
 - ◆ Imaging & Web Publishing
 - ◆ Electronic Calendars
 - ◆ Desktop Databases
- OAS can support office workers' activities.



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Functions of Office

- Managing & coordinating the work of data & knowledge workers.
- Connecting the work of the local information workers with all levels and functions of the organization.
- Connecting the organization to the external world, including customers, suppliers, government regulators, and external auditors.

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Activities of Officer Workers

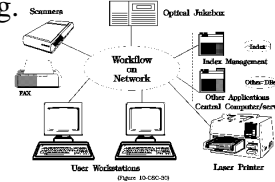
- Managing documents.
- Scheduling for individuals & groups.
- Communicating, including initiating, receiving, and managing voice, digital, and document-based communications for individuals & groups.
- Managing data, such as on employees, customers, and vendors.

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Document Imaging Systems

- Systems that convert documents & images into digital form so they can be stored and accessed by the computer.
- If the document is not in active use, it usually is stored on an optical disk system.
- An imaging system requires an Index Server to contain the indexes that will allow users to identify and retrieve a document when needed.
- Intranets provide a low-cost and universally available platform for basic document publishing.



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Knowledge Work Systems (KWS)

- Support activities of highly skilled knowledge workers and professionals as they create new knowledge and try to integrate it into the firm.
 - ◆ Computer-Aided Design (CAD)
 - ◆ Virtual Reality (VR)
 - ◆ Investment Workstations.



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Roles of Knowledge Work Systems

- Keeping the organization up-to-date in knowledge as it develops in the external world – in technology, science, social thought, and the arts.
- Serving as internal consultants regarding the areas of their knowledge, the changes taking place, and the opportunities.
- Acting as change agents evaluating, initiating, and promoting change projects.

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Characteristics of Knowledge Work Systems

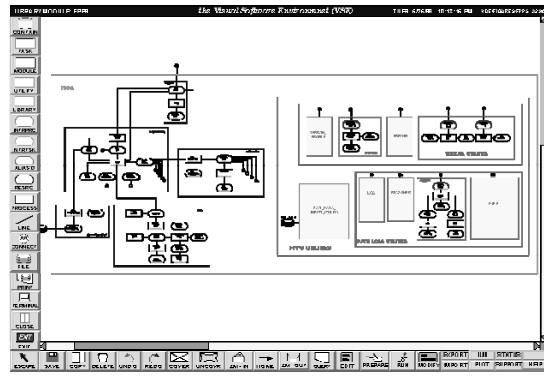
- It must give knowledge workers the specialized tools they need, such as powerful graphics, analytical tools, and communications and document-management tools.
- A user-friendly interface.
- Designed & optimized for specific tasks to be performed.

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Computer-Aided Design (CAD)

- Information System that automates the creation & revision of designs using sophisticated graphics software.



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Virtual Reality (VR) Systems

- Interactive graphics software and hardware that create computer-generated simulations that provide sensations that emulate real-world activities.
- Virtual reality applications are being developed for the Web using a standard called Virtual Reality Modeling Language (VRML).

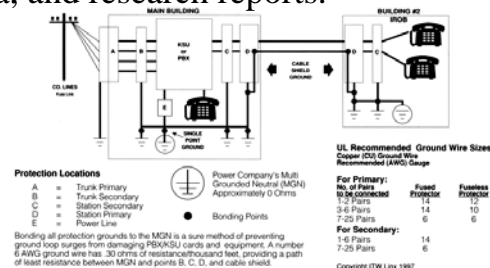


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Investment Workstation

- Powerful desktop computer for financial specialists, which is optimized to access and manipulate massive amounts of financial data, both internal and external sources, including contact management data, real-time and historical market data, and research reports.



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Group Collaboration Systems

- Support the creation and sharing of knowledge people working in groups.
 - Groupware
 - Intranets

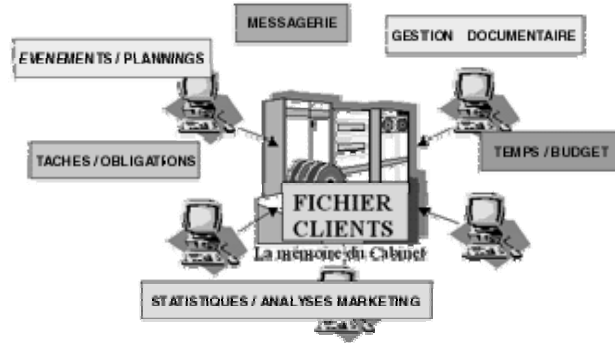


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Groupware

- Software that recognizes the significance of groups in offices by providing functions and services that support the collaborative activities of work groups.



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Intranet Knowledge Environments

- Intranets provide the foundation for knowledge environments in which information from a variety of sources and media, including text, sound, video, and digital slides can be shared, displayed, and accessed across an enterprise through a simple common interface.



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Artificial Intelligence Applications

- Provide organizations and managers with codified knowledge that can be reused by others in the organization.
 - ◆ Expert Systems
 - ◆ Neural Nets
 - ◆ Fuzzy Logic
 - ◆ Genetic Algorithms
 - ◆ Intelligent Agents



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What is Artificial Intelligence (AI)?

- Artificial Intelligence (AI) can be defined as the effort to develop computer-based systems (both hardware and software) that behave as humans.
 - ◆ Learn natural language
 - ◆ Accomplish coordinated physical tasks – robotics
 - ◆ Use a perceptive systems that informs their physical behavior and language – visual and oral perception systems.
 - ◆ Emulate human expertise and decision making – expert systems.
 - ◆ Intelligent machines, the physical hardware that performs these tasks.

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Differences between AI and Human Intelligence

AI	Human
Lacks of common sense and generality	Has common sense or generality
Incapable to impose a conceptual apparatus in the environment	Capable of think in terms of meta-concept such as cause-and-effect and time

Why Business interested in AI?

- To preserve expertise that might be lost.
- To store information in an active form.
- To create a mechanism that is not subject to human feelings such as fatigue & worry.
- To eliminate routine & unsatisfying jobs held by people.
- To enhance the organization's knowledge base by suggesting solutions to specific problems that are too complex to be analyzed by human.

Expert System

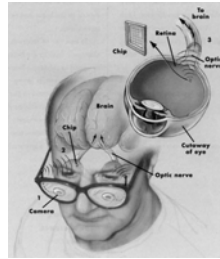
- Knowledge-intensive computer program that captures the expertise of a human in limited domains of knowledge.
- An expert system can assist decision making by asking relevant questions and explaining the reason for adopting certain actions.
- Expert systems lack breadth of knowledge and the understanding of fundamental principles of a human expert. They typical perform very limited tasks that can be performed by professional.

Knowledge Base

- Model of human knowledge that is used by expert systems.
 - ◆ Rules:
 - ◆ Interconnected and nested IF-THEN statements
 - ◆ Knowledge Frames
 - ◆ A method of organizing expert system knowledge into chunks; the relationships are based on shared characteristics determined by the user.

Artificial Vision

- It is based on electronic-based strategies designed to bypass various defects or missing links along the brain's image processing pathway and provide some form of artificial sight for the blind man.
- Images are feed from a digital camera with a belt-mounted signal processor and sent through the skull, and into the visual cortex.



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AI Shell

- The programming environment of an expert system.

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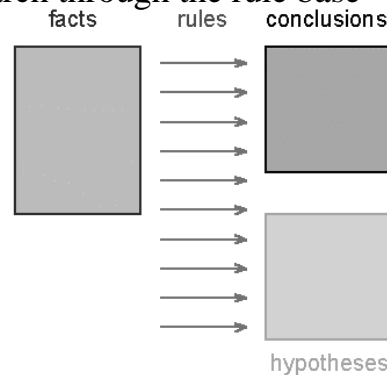
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Inference Engine

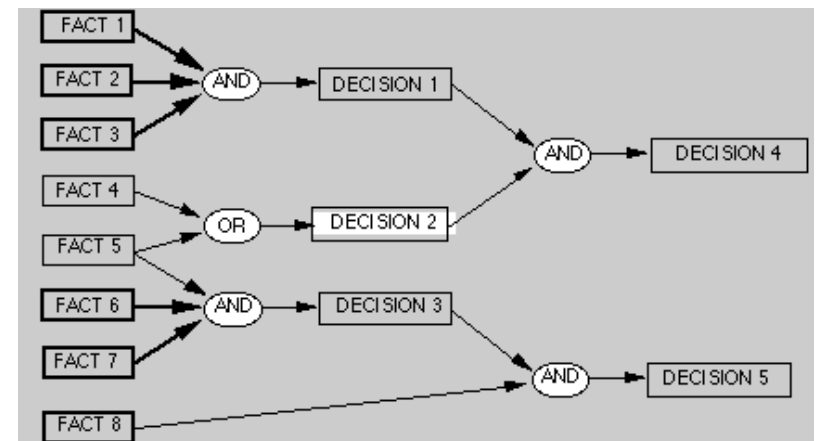
- That part of an expert system that actually performs the reasoning function
- The strategy used to search through the rule base in an expert system
 - Forward Chaining
 - Backward Chaining



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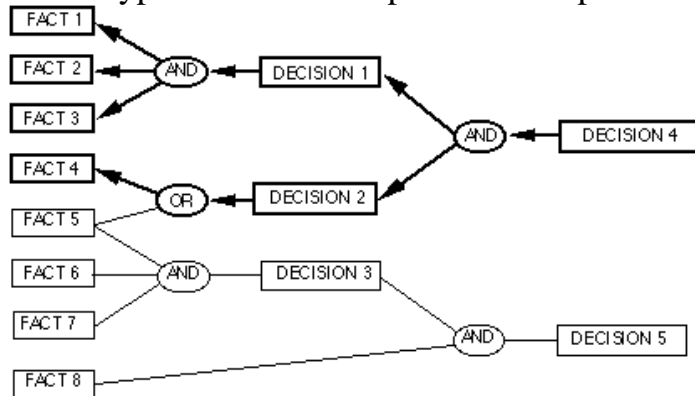
Inference Engine - Forward Chaining

- It begin with the information entered by user and searches the rule base to arrive at a conclusion.



Inference Engine - Backward Chaining

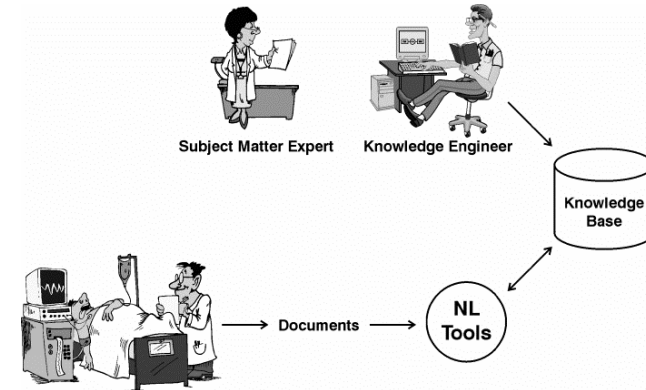
- It acts like a problem solver by beginning with a hypothesis and seeking out more information until the hypothesis is either proved or disproved.



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Knowledge Engineer

- A specialist who elicits information and expertise from other professionals and translates it into a set of rules or frames for an expert system.



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Benefits of Expert Systems

- Reduced errors
- Reduced cost
- Reduced training time
- Improved decisions
- Improved quality and service

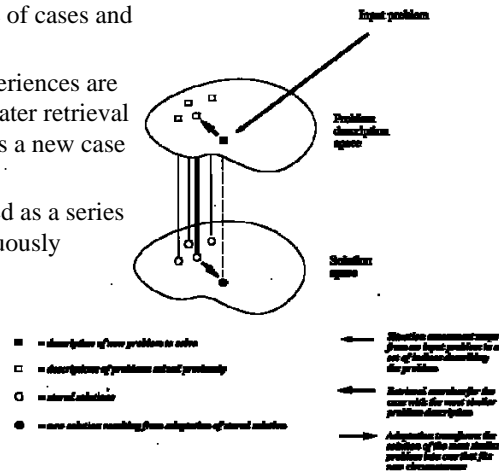


Expert Systems Problems

- Only certain classes of problems can be solved by expert systems.
- Knowledge base cannot learn.
- Expert Systems can only represent limited form of knowledge (IF-THEN rules).

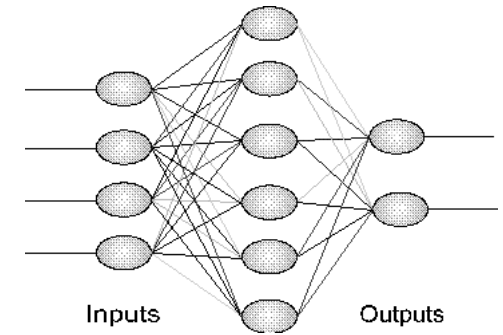
Case-Based Reasoning (CBR)

- It is an AI technology that represents knowledge as a database of cases and solutions.
- Descriptions of past experiences are stored in a database for later retrieval when the user encounters a new case with similar parameters.
- Knowledge is represented as a series of cases which is continuously expanded and refined.



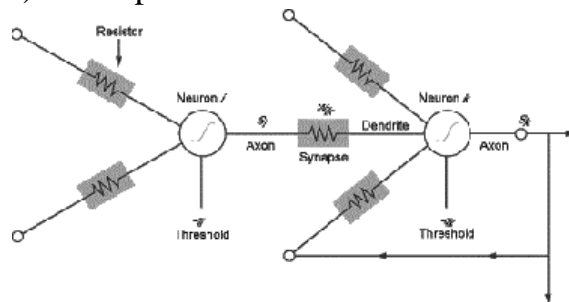
Neural Network

- There has been interest in bottom-up approaches to AI in which machines are designed to imitate the physical thought process of the biological brain.
- A neural network consists hardware and software that attempts to emulate the processing patterns of the biological brain.



Architecture for Neural Network

- Artificial neural network with two neurons. In artificial neurons, the biological neurons become **Processing Elements** (switches), the *axons* and *dendrites* become **Wires**, and the *synapses* become variable **Resistors** that carry weighted input (currents) that represent data.



Learning in Neural Network

- A neural network uses rules it “learns” from patterns in data to construct a hidden layer of logic.
- The **Hidden Layer** then processes inputs, classifying them based on the experience of the model.

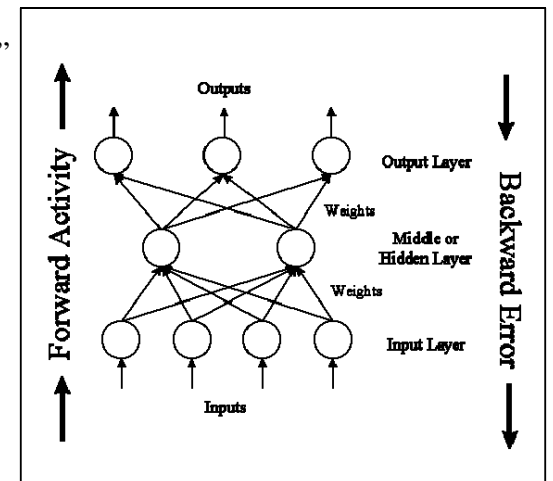
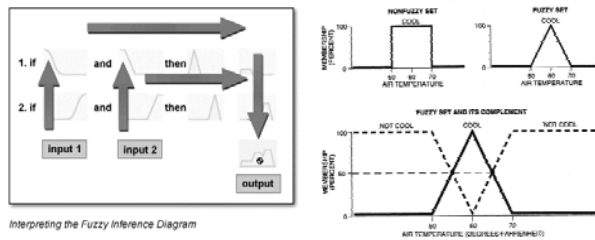


FIGURE 4.1. Typical Artificial Neural Network Setup (Caudill and Butler, 1992a).

Fuzzy Logic

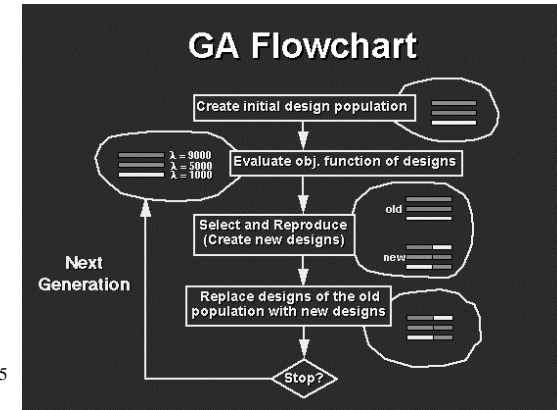
- A rule based AI that tolerates imprecision by using specific terms called membership functions to solve problems.
- Consists of a variety of concepts and techniques for representing and inferring knowledge that is imprecise, uncertain, or unreliable.
- Fuzzy logic can create rules that use approximate or subjective values and incomplete or ambiguous data.



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Genetic Algorithm (Adaptive Computation)

- Problem-solving methods that promote the evolution of solutions to specified problems using the model of living organisms adapting to their environment.

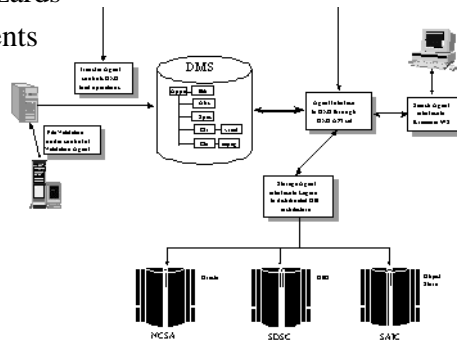


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Intelligent Agent

- Software program that work in background using a built-in or learned knowledge base to carry out specific, repetitive, and predictable tasks for an individual user, business process, or software application.
 - ◆ Microsoft Office Wizards
 - ◆ Schedule Appointments
 - ◆ Delete Junk Email



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Hybrid AI Systems

- Integration of multiple AI technologies into a single application to take advantage of the best features of these technologies.

HYBEXP:
A hierarchically structured hybrid AI system

Hybrid AI approaches
Several techniques for integrating expert systems and neural networks have emerged over the past years from simulation, through nonformalized, loosely- and rigidly-coupled to fully-integrated models.

A hierarchical solution
In the hybrid AI concept of control systems elaborated in the framework of an international research project supported by the EU, outputs of artificial neural networks (ANNs) are conveyed to an expert system (symbolic level). In the other direction, the symbolic level influences the functioning of the subsymbolic (ANN) level. On the basis of accumulated knowledge, the hybrid system generates optimal process parameters and informs the user about the current state of the process.

Application in manufacturing
In pilot application aiming at the control and monitoring of manufacturing processes, the symbolic part forwards (I) process parameter information (feed rate, depth of cut, cutting speed) to the machine tool (C). The generated indirect signals (e.g. force components, vibration) are measured and conveyed (II) to the subsymbolic part (A) of the hybrid system.

Publications
[1] Benschärf, D., Monostori, L., Wozniak, G.W., Eggenls, C., Kádár, B.: Approaches to coupling connectionist and expert systems in intelligent manufacturing. Prep. of the Second Int. Workshop on Learning in IMS, April 20-21, 1995, Budapest, Hungary, pp. 91-102.
[2] Monostori, L.: Hybrid AI approaches for supervision and control of manufacturing processes. Proc. of the ACCS, IV Int. Conf. on Monitoring and Aut. Supervision in Manufacturing, Aug. 28-29, 1995, Poland, pp. 37-47.

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