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Advances in Computer and Information Sciences

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ISCIS'2000

15th ISCIS

since 1986

To be part of the 15th annual ISCIS:

- **For all the contributing scientists** coming from several countries as well as for their Turkish counterparts:
  – a great source of pride and joy

- **For me**:
  – a source of honor

"One can be part of civilization to the extent one *contributes* to its advancement **and not** by procuring and using/consuming its products and/or services alone."

The **cumulative bibliography** of the ISCIS Proceedings (Diri 2000) :

- **reflects** the **international efforts** for the *accumulation of advanced knowledge* on Computer and Information Sciences and

- **testifies** the *ISCIS' contributions* to the advancement of contemporary civilization.

KNOWLEDGE, KNOWLEDGE PROCESSING, and THE SHIFT OF PARADIGM

- For a long time in the history of civilization, **being knowledgeable was** an important asset.

- Information age realities provide tools *to store* and *interactively access* a vast amount of knowledge.

- All the knowledge we get through formal education can reside on a single CD-ROM where the knowledge can be stored for interactive search without any loss.

- Libraries were places to work as **repositories of human knowledge**. Now, information technology shrinks drastically the storage requirements and offers interactive search capabilities.

- Furthermore, "with Internet, geography became history."

- **Knowledge processing ability** became **more important** than knowledge itself.

- Indeed, knowledge is necessary but not sufficient to solve problems. For example, *neither a library nor a CD-ROM can solve a problem*.

- Therefore, knowledge processing and **especially cognitive knowledge processing** have to be explored to get the benefits of computerization.

KNOWLEDGE PROCESSING EVERYWHERE

Knowledge processing is done by two types of machines or systems:

- *machines for knowledge processing* and

- *machines with knowledge processing abilities*.

	fixed-wired tools	variable-wired tools	stored-program tools
machines for knowledge processing	• abacus • astrolabe • …	• unit record • hybrid computers	• **computers** - PC - notebook - palm - wearable - *implentable?*
machines with knowledge processing abilities			

	fixed-wired tools	variable-wired tools	stored-program tools
machines for knowledge processing	• abacus • astrolabe • …	• unit record • hybrid computers	• **computers** - PC - notebook - palm - wearable - *implentable?*
machines with knowledge processing abilities	• automata	• Jacquard loom	• computer-**embedded systems** (**CES**) (pre-/re-/auto-) programmable systems

Types of knowledge processing	Types of CES	Examples
Set parameter values & comp.	**Knowledge-based CES**	**Camera reads directly film speed**
Optimization	**Optimizing CES**	**Tracking missile Vehicle-sensing road**
Reasoning	**Reasoning or rule-based CES**	**Rule-based robot**
Simulation	**Simulative CES**	**Predictive displays generated via on-line simulation**
Multiparadigm kp ability	**Multiparadigm CES**	**(semi-)autonomous system with abilities for comp., opt., reasoning, and sim.)**

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Highlights of Software Engineering Paradigms

Paradigm	Types of Programming
Imperative programming	• Procedural programming • Structured programming • Object-based programming
Interactive programming	• Event-based programming
Declarative programming	• Functional programming • Logic programming
Delegated programming	• Agent-based programming

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WHAT'S NEXT ? Some Points

Denning, P.J. and R.M. Metcalfe (1997). Beyond Calculation – The Next Fifty Years of Computing. New York: Copernicus/Springer-Verlag.

Computers are still very young.

What we witness is just the beginning.

1. Software agents

- Agents are software modules
  - with **cognitive abilities** that
  - can work as **assistants** to users (humans or other agents)
- They can observe their environments as well as they can affect it.

- **Cognitive abilities** include:

  (quasi-)autonomy, perception, motivation, reasoning, assessing, understanding, learning, goal processing, and goal-directed knowledge processing.

Mobile agents and distributed computing

- extend the concept of **computational platform** to **whole** or **part of the net** on intranets and on the Internet.

2. System theories

provide strong backgrounds for cognitive, i.e., **intelligent computerization**.

For example,

systems with **understanding** abilities

systems with **learning** abilities

systems with **adaptation** abilities

systems with **anticipation** abilities

3. Cooperation

is becoming an important paradigm for both civilian and military applications.

Holonic systems

- **Holons*** provides a powerful paradigm to conceive, model, support, and manage **dynamically organizing complex cooperative systems**.

* from Greek *holos*, whole

- A **holonic system** is composed of **autonomous entities** (called holons) that can *deliberately reduce their autonomy*, when need arise, to collectively achieve a goal.

4. Agent-directed simulation

Agent-directed simulation

= synergy of simulation and software agents

- **Agent simulation**

- **Agent-based simulation**

- **Agent-supported simulation**

- **Agent simulation** is simulation of agents that represent natural or **engineered intelligent systems**.

- **Multi-agent simulation** denotes simulation of a collection of agents (or agency).

- **Agent simulation or multi-agent simulation is very important and promising!**

- **Can simulate any intelligent entity** (humans, intelligent weapons, intelligent systems, ...)

- **Agent-based simulation** is a simulation study where the behavior of models are generated by using agent technology.

- May have technical merits;

  however, **agent simulation** is more intuitive to grasp! (since it deals with simulation of intelligent entities.)

- **Agent-supported simulation** is simulation where agent technology is used to support simulation operations.

Agent-supported simulation

1. to support **user/software interface functions:**
   - help, guidance, very high-level problem specification, explanation, interpretation

2. **agent-supported simulation quality assurance. (VV&A)**

3. to support **processing of simulation programs**
   - agent-supported **simulation program generation / integration (HLA)**
   - agent-supported **simulation program comprehension.** (for program maintenance)

5. Holonic system simulation

- **Holonic agent simulation**
(or **holon simulation**, in short)
is an important type of **agent simulation** where agents represent holons.

We have seen: "**Advances in Computer and Information Sciences**"

1. ISCIS 2000 – 15th ISCIS

2. Knowledge, knowledge processing, and shift of paradigm

3. Knowledge processing everywhere

4. What's next? Some points:

    - Software agents, system theories,

    - Cooperation: holonic systems

    - Agent-directed simulation

    - Holonic system simulation