1994 C

INTERNATIONAL JOURNAL ON

ARTIFICIAL INTELLIGENCE TOOLS

(Architectures, Languages, Algorithms)

AI THEORY

AI TOOLS

AI APPLICATIONS

VOLUME 3 NUMBER 1 MARCH 1994

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paradigm are as follows:

- Spawning and mapping concurrent processes either on MIMD architectures or pipelined vector computers [3, 4]: these models suffer from combinatorial explosion of processes. In process based models overhead of spawning processes is linearly proportional to the number of data elements. Such schemes are not suitable for data intensive problems which need same abstract computation on a large amount of data.
- Simulation of conventional abstract machines [5] on massive parallel machines: these models simulate pointer based data representation, and indexing based upon predicate name to identify procedures used for goal reduction. The use of pointer based data representation causes inherent sequentiality, and indexing scheme restricts the query power.
- Exploitation of associative search and data parallel computation [6, 7, 8]: these models do not exploit intertwining of search by content and data parallel computation.
- Loose coupling of intelligent reasoning on conventional architectures using conventional data representation and data parallel scientific computing on massively parallel supercomputers: these schemes suffer from data transfer overhead between architectures and run time overhead to transform data between conventional data representation schemes and data representation schemes on massively parallel supercomputers.

The implementations based upon conventional models, which use indexing on predicate-name to select a clause and pointer-based data representation, are incapable of answering a large class of queries needed in real world knowledge retrieval and data parallel computation. Some examples are

(a) queries which derive the set of objects based upon incomplete information about their attributes,
(b) queries which relate one or more objects without *a priori* knowledge of the relaionship,
(c) queries which reason about meta-relations — relations relating relations — about the objects, and
(d) queries integrating inequalities, ranges and data parallel computations.

The following two examples illustrate the above deficiencies: Example 1 illustrates the power of associative search to derive unspecified relations for the given attributes and handling of queries with meta-relations; Example 2 illustrates intertwining of search by content, inequality tests, and data parallel computation.

Example 1:

Conventional models answer queries such as "Who is a sister of Tom?"; "Who is a brother of Mary"?; "Who is a parent of Mary?"; "Who is a parent of John" etc

These models can not answer queries such as "How are Tom and Mary related?"; "How are Mary and John related?"; "Specify the relatives and their corresponding relationships to Tom?"; and "Who are relatives of Tom?". The corresponding query formulations are given in Table 1: the first column illustrates the class of queries, the second column illustrates formulation, the third column shows the query processing scheme, and the fourth column shows the processing capability of conventional systems.

% Meta relations

relative(sister). relative(brother). relative(parent).

% Concrete relations

brother(X, Y) :- parent(Z, X), parent(Z, Y), male(X), not_same(X, Y).

sister(X, Y) :- parent(Z, X), parent(Z, Y), female(X), not_same(X, Y).

parent(jane, mary). parent(ram, mary).
parent(jane, tom). parent(ram, john).

male(tom). male(john) male(ram).

female(mary) female(jane).

Table 1. Query power extension in associative model.

GR: Goal reduction, FL: fact lookup, MR: meta relation

Class	Goal	Type	Con.
brother of mary?	*brother(mary, X)?*	GR	Yes
relationship of tom with mary?	*P(tom, mary)?*	FL	No
relationship of mary with tom ?	*P(mary, tom)?*	GR	No
relationships and relatives of tom?	*P(tom, X)?*	GR	No
relatives of tom?	*relative(P)* $\wedge$	MR	No
	P(tom, X)?	GR	

Example 2:

Consider a large data base of employees in a company. We have to identify the set of employees within the salary range *25,000* < *salary* < *35,000* in a specific department "D". The salaries of these employees have to be raised by 5%. First the subset of employees is selected using associative search with inequality tests *salary* > *25,000* and *salary* < *35,000*, and equality test *department* = "D". After the selection of the subset, data parallel computation is used to compute the raise. This intertwining of associative search and data parallel computation is not possible in conventional systems.