



THE SP SYSTEM AS AN AID TO CRIME PREVENTION AND DETECTION (CPD)

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THE SP SYSTEM

Very roughly, the **SP theory of intelligence** (expressed in the **SP computer model**) is:

- A **database system**...
- ...with **intelligence**.

SIMPLIFICATION AND INTEGRATION

- Computer science, including artificial intelligence, has become very **fragmented**:
- The SP system aims to **simplify** and **integrate** ideas in computing.
- The key to simplification and integration is **multiple alignment** (next).



MULTIPLE ALIGNMENT: A CONCEPT BORROWED (AND ADAPTED) FROM BIOINFORMATICS

```
      G G A      G      C A G G G A G G A      T G      G      G G A
      | | |      |      | | | | | | | | | |      | |      |      | | |
      G G | G      G C C C A G G G A G G A      | G G C G      G G A
      | | |      | | | | | | | | | | | |      | |      |      | | |
A | G A C T G C C C A G G G | G G | G C T G      G A | G A
      | | |      | | | | | | | | | |      | |      |      | | |
      G G A A      | A G G G A G G A      | A G      G      G G A
      | | |      | | | | | | | | | |      | |      |      | | |
      G G C A      C A G G G A G G      C      G      G      G G A
```

AN SP MULTIPLE ALIGNMENT

0			t	h	e			a	p	p	e	s		a	r	e		s	w	e	e	t	0	
1								N	Nr	6	a	p	p	e	#N								1	
2								N	Np	N	Nr			#N	s	#N							2	
3			D	17	t	h	e	#D															3	
4			NP	0a	D		#D	N						#N	#NP								4	
5															V	Vp	11	a	r	e	#V		5	
6	S	Num	;		NP									#NP	V			#V	A				#A	#S
																								6
7																		A	21	s	w	e	e	t
																							#A	7
8	Num	PL	;				Np							Vp										8

- **Multiple alignment** is central in the SP system.
- **Multiple alignment** is **very versatile** (next).

VERSATILITY AND ADAPTABILITY OF THE SP SYSTEM

- **Unsupervised learning**: a foundation for all other kinds of learning.
- Representation of **several different kinds of knowledge**.
- **Several different kinds of reasoning**.
- **Pattern recognition** with potential for **computer vision**.
- Processing of **natural language**.
- **Information storage** and **retrieval**.
- **Planning**.
- **Problem solving**.

SEAMLESS INTEGRATION IN THE SP SYSTEM

- A potential advantage of the SP system is that it has potential for **seamless integration** (SI) of **different kinds of knowledge** (DK) and **different aspects of intelligence** (DI) — (SIDKDI).
- This is because **multiple alignment** has potential to be a **universal framework** for DK and DI.
- SIDKDI appears to be **essential** if we are to achieve human-like versatility and adaptability in artificial intelligence. **In reasoning, people naturally make use of many different kinds of knowledge and many different aspects of intelligence.** Consider reasoning in “whodunnit” scenarios.

THE POTENTIAL OF THE SP SYSTEM IN CPD — SUMMARY

- The SP system as a **versatile database system**, with **intelligence**.
- Unsupervised **learning**.
- Several kinds of **reasoning**.
- **Planning** and **problem solving**.
- **Pattern recognition** and **computer vision**.
- Processing of **natural language**.
- **Transparency** and **visualisation**.

THE SP SYSTEM AS A VERSATILE DATABASE SYSTEM, WITH INTELLIGENCE

- **Storage** of information
 - Efficiency in use of storage space.
 - Efficiency in transmission of information.
- **Retrieval** of information (**ED** = relevant to eDiscovery)
 - Query-by-example.
 - Natural language queries.
 - SQL.
- **Versatility** in representing different kinds of knowledge and with different aspects of intelligence. **ED**
- **Seamless integration** of different kinds of **knowledge** and different aspects of **intelligence**. **ED**

UNSUPERVISED LEARNING

- The SP system has strengths and potential in **unsupervised learning** (the inspiration for the system).
- It means learning **without a “teacher”** or anything equivalent. Most human learning is unsupervised.
- It is the foundation for “reinforcement learning”, “learning by imitation”, “learning by being told”, and more.
- For CPD, it can mean:
 - The discovery of significant **structures, patterns, or associations** in data, including patterns of activity, associations amongst people, habits of individuals, and many more. **ED**
 - Automatic or semi-automatic **organisation of unstructured or semi-structured** information. **ED**

SEVERAL KINDS OF REASONING, WITH OTHER ASPECTS OF INTELLIGENCE

- The SP system supports **several kinds of reasoning** that can work together and with **other aspects of intelligence**, in any combination. **This is a major strength of the system.**
- For CPD, this can mean:
 - Recognising patterns of activity that precede acts of terrorism.
 - Working out who may be planning a crime or act of terrorism, and where, and how.
 - Following chains of reasoning and patterns in “whodunnit” investigations.

PATTERN RECOGNITION AND COMPUTER VISION

The SP system has strengths and potential in:

- Recognising patterns in data, including such things as patterns of activity, or language styles, that have been previously learned by the system. **ED**
- Recognising or retrieving such things as finger prints or DNA samples that are **the same as** or **similar to** a given target. **ED**
- Computer vision: analysis and interpretation of scenes, recognition of people from different angles, recognition of objects and their significance, **ED**

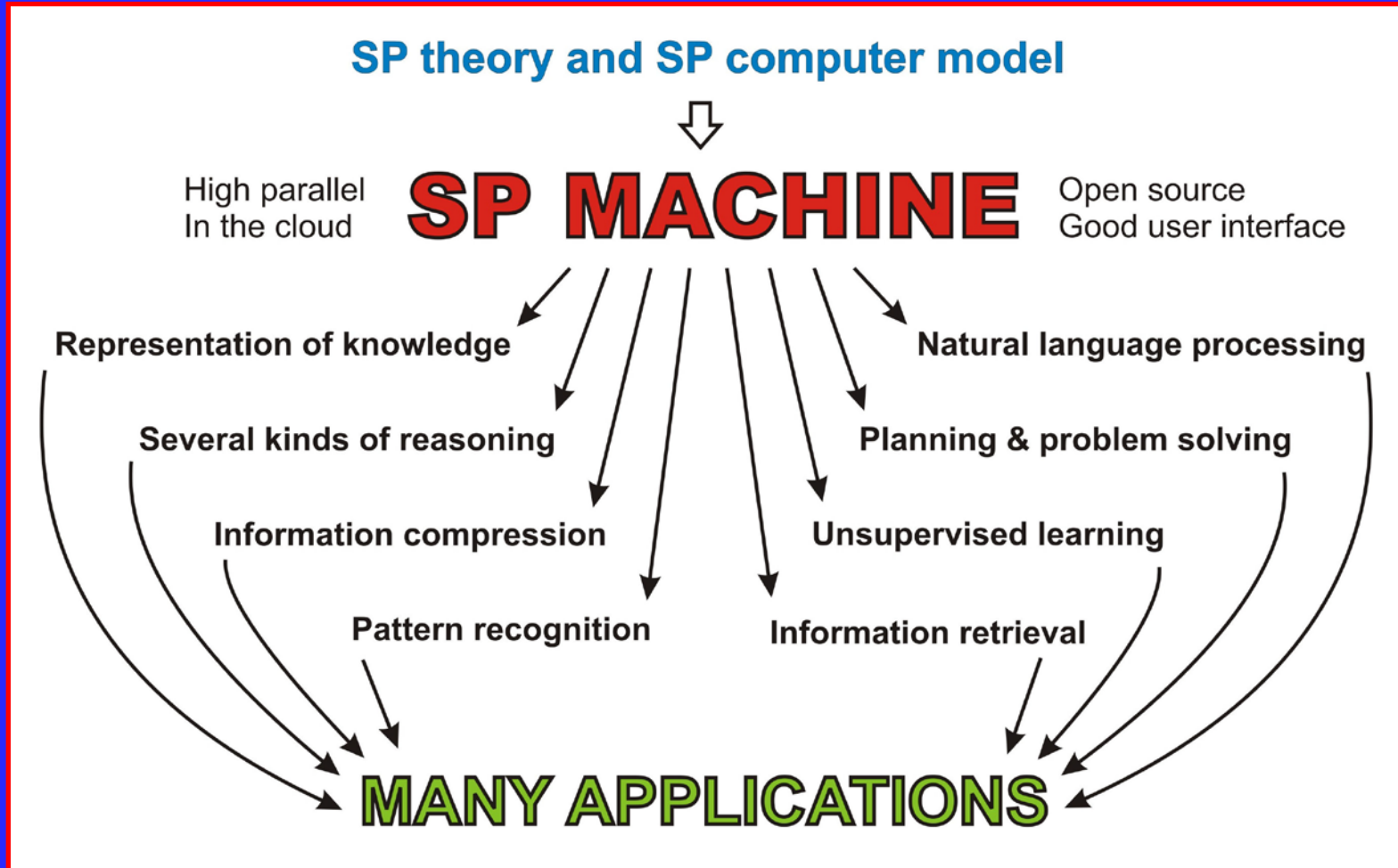
PROCESSING OF NATURAL LANGUAGE

- The SP system has strengths and potential in:
 - Parsing (analysis) and production of natural language without meanings.
 - Understanding natural language and production of language from meanings.
 - Translation between natural languages via meanings.
- Potential applications in CPD, include understanding conversations by suspects, understanding legal documents, and help in composing reports.
- Seamless integration of NL with other aspects of intelligence.
- More ambitious than NL in current AI applications.

TRANSPARENCY AND VISUALIZATION

- In the SP system there is **transparency** in:
 - **How knowledge is organised** (cf deep learning and artificial neural networks).
 - **Processing** — there is an **audit trail** for all processing.
- Static and moving **graphics** may help **visualisation** of knowledge and processing.
- This is likely to be important in:
 - Assessments of **security** against crime or terrorism.
 - **Legal issues** arising from crime or terrorism.

A HIGH-PARALLEL SP MACHINE AS A VEHICLE FOR RESEARCH





FURTHER INFORMATION

- www.cognitionresearch.org/sp.htm .
- **Papers:** There are details of several papers, many with download links, on the above web page.
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