On the Information Overload Problem

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ABSTRACT

There remains no universal, cross-disciplinary definition of **information overload** (IO). Colloquially, we understand information overload to be simply what occurs when there is **too much information**.

In computer science, IO is in no way an unprecedented phenomenon, but demands to be reexamined in the modern context of big data. We aim to **perform a review of the preexisting literature** on information overload in the fields of cognitive science, psychology, information science, and organizational science. We seek to **define information overload in the context of computer science** and **explore a case study of descriptive clustering**, a potential IO solution.

LITERATURE REVIEW

We performed a literature review from a number of different disciplines. From that survey, we have condensed the results into a table categorizing the various causes of information overload.

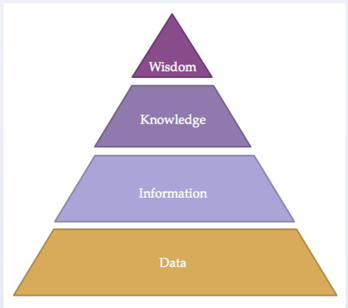
Table 2: Causes of Information Overload

Information Quantity	- Amount of unprocessed information	Bawden, 2001; Herbig and Kramer, 1994; Jacoby et al., 1974; Jacoby 1977, 1984; Malhotra, 1982, as cited in Eppler and Mengis, 2004
	- Scale and acceleration of new information	Ho and Tang, 2001
Information Quality	- Ambiguity of information	Schneider, 1987
	- Novelty of information	Schneider, 1987
	- Complexity of information	Schneider, 1987
	- Intensity of information	Schneider, 1987
	- Overabundance of irrelevant information, i.e. data smog	Tushman and Nadler, 1975; Ho and Tang, 2001
	- Signal-to-noise dynamics	Edmunds and Morris, 2000
	- Information uncertainty	Tushman and Nadler, 1975
	- Information format and display	Eppler and Mengis, 2004
Environment	- Push technologies, such as email or IM	Bawden, 2001
	- Notification systems	Edmunds and Morris, 2000
	- Speed and ease of access	Schultze and Vandenbosch, 1998
	- Interruptions during complex tasks	Speier et al., 1999
	- Pressured work environments	Schick et al., 1990
Human Ability	- Cognitive processing bandwidth	Miller, 1956
	- Motivation, attitude, and satisfaction	Owen, 1992; Hiltz and Turoff, 1985; Muller, 1984; Schneider, 1987; Swain and Haka, 2000; as cited in Eppler Mengis, 2004
	- Mood and personal factors, such as level of sleep	Owen, 1992
	- Experience with information processing	Eppler and Mengis, 2004

DEFINITIONS

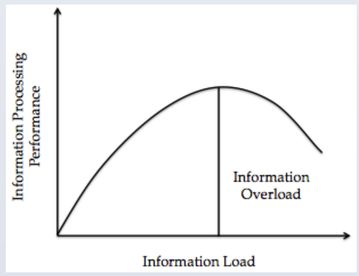
"Information"

In the domain of technology, we rely on **the DIKW hierarchy**, borrowed from the field of information science, to define and differentiate between data, information, wisdom, and knowledge. Based on this hierarchy, we define information as **data that is interpreted and packaged to be communicated**.

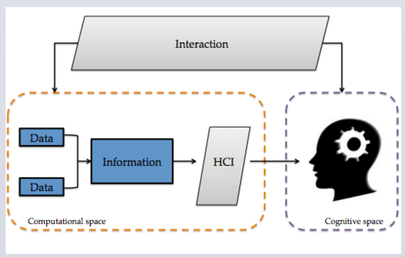


"Overload"

Historically, scholars have represented information overload schematically as a **function of information load and processing performance**, often represented by the inverted U-curve.



In the context of computer science, we found that IO is less a function of information load than *perceived* information load. Thus, information overload is affected by the delivery of information in the **computational space** as well as the processing of information in the **cognitive space**.



CASE STUDY

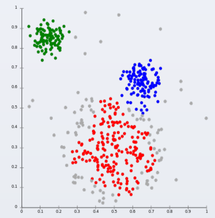
Descriptive Clustering

Descriptive clustering combines information retrieval, text mining, and traditional clustering to create clusters described with **meaningful, comprehensible, and compact text labels**.

Research Problem

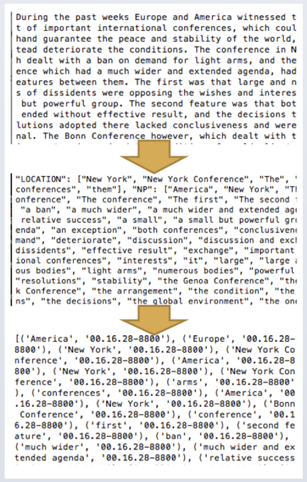
How do we give **semantic meaning** to **mathematically optimized** data clusters in order to minimize information overload? How should we change our approach to clustering such that clustering:

- Creates sensible cluster labels
- Explains patters
- Summarizes data
- Identifies topics



Methods

Frequency-based offline document clustering



- MPQA Opinion Corpus (2002) of ~400 news articles
- Extract relevant noun phrases with Stanford Named Entity Recognizer (NER)
- Implement a greedy algorithm for set covering
- Each element represents a labeled cluster

Results

~40 descriptive clusters

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['UNITED STATES', 'CHINA', 'AFGHANISTAN', 'ISRAEL', 'RUSSIA',
'WASHINGTON', 'ZIMBABWE', 'ARGENTINA', 'MARCH', 'PRESIDENT', '
PEOPLE', 'NOVEMBER', 'POLICE', 'BETHLEHEM', 'KAZAKHSTAN', 'DEC
', 'ENGLISH', 'GUANTANAMO', 'S', 'JAKARTA', 'NUMBER', 'JAMMU',
 'SAUDI ARABIA', 'ASIA', 'AUGUST', 'UZBEKISTAN', 'TASS', 'SALO
NICA', 'BANGUI', 'SOCIETY', 'EUROPE', 'STOIBER', 'HAJJI ISA SE
BI', 'PALESTINIANS', 'SOUTH KOREA', 'PRIME MINISTER', 'COLOMBO
', 'TURKMENISTAN', 'BC', 'CHINESE', 'COMPUTERS', 'ONE TRADER',
 'MR_SUNIL MITTAL', 'MONDAY JANUARY', 'REPORT']
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CONCLUSION

Based on our research and the preexisting literature, we define information overload in the context of computer science as **a phenomenon that occurs when the sensation of information burden results in the inability to optimally process information.**

REFERENCES

Eppler M. and Mengis J. 1969. The Concept of Information Overload: A Review of Literature from Organizational Science, Accounting, Marketing, MIS, and Related Disciplines. The Information Society: An International Journal. 20(5). pp325-344

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Miller G. 1956. The Magical Number Seven, Plus or Minus Two: Some Limits On Our Capacity for Processing Information. The Psychological Review. Vol. 63. pp81-97.

Misra S. and Stokols D. 2011. Psychological and Health Outcomes of Information Overload. Environment and Behavior. 44(6). pp737-759.

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