AI-ENABLED BANKING

Dr. Amin Beheshti

Founder – Big Data Society

Director – Data Analytics Research Lab

Department of Computing

MACQUARIE University
SYDNEY·AUSTRALIA

9 Dec 2020 – Sydney, Australia

The Increasing Importance Of Collaboration Between Universities And External Partners

- ***We Live in a Fast-paced World of Ideas:***

  Universities: Can identify the next big idea!

  Companies: Can see early signals of what's going to be the next big opportunity!

- ***Commercialising Good Ideas:***

  "Australia is a world leader in the quality of research but falls behind when it comes to commercialising good ideas and collaborating with industry," Minster for Education, Simon Birmingham

- ***Sustainable Socioeconomic Development:***

  Growth that brings benefits and opportunities equally across all segments of society.

What we did?

Big Data Society: Hackathons, Workshops, Seminars, …

ITIC — Diamond Sponsor

TATA CONSULTANCY SERVICES — Platinum Sponsor

IBM — Diamond Sponsor

Microsoft — Silver Sponsor

aws — Gold Sponsor

SAS — THE POWER TO KNOW. — Platinum Sponsor

Yellowfin — Gold Sponsor

engenesis — Bronze Sponsor

AGATE™ — Platinum Sponsor

What we did?

External Research Partnership – Over $3.9 million

- "AI-enabled Banking"; MQ Linkage": Tata Consultancy Services (TCS) and MQ, 2019-2023
- "Linking Cognitive Technology and Sensory Systems to Support Personalized Learning", MQ Linkage: ITIC Training and Resourcing and MQ, 2020-2021
- "AI-enabled Industry: Challenges and Opportunity Study"; Funded by Federal Innovation Connections Grant; Linkage: Faethm Pty Ltd. and MQ, 2019-2021
- "Intelligent Educational Knowledge Lake"; MQ Linkage: Cinglevue International Pty Ltd and MQ, 2020-2023
- "AI-enabled Identity Verification", MQ Linkage: Locii Innovations Pty Ltd and MQ, 2020-2022
- "Cognitive Recommender Systems"; MQ Linkage: dAIta Pty Ltd and MQ, 2020-2024
- "Intelligence-led Teaching and Learning"; Linkage: ITIC Training and Resourcing and MQ, 2019-2023
- "Enterprise Insight Analysis"; Linkage: Prospa Advance Pty Ltd. and MQ, 2019-2022
- "Price optimisation using deep reinforcement learning"; Intellify Pty Ltd. and MQ, 2019-2022

External Research Partnership – NEXT LEVEL !!

AI-enabled Banking:
Scholarships for 5 PhD Students + 5 MRes Students

Cognitive Open Banking:
Funding for 10 PostDocs

TCS-MQ Hackathon (OPEN BANKING):
9-10 Dec 2020

TATA
TATA CONSULTANCY SERVICES

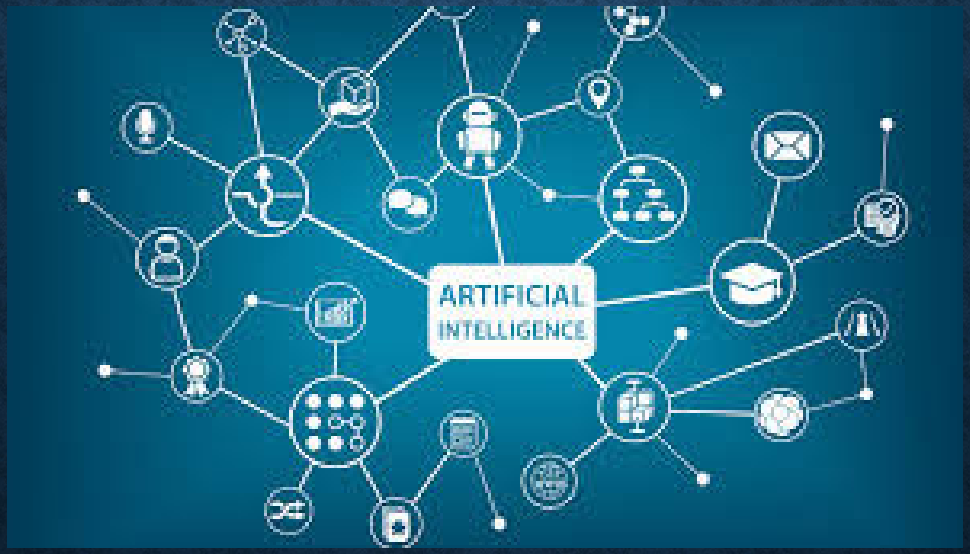
MACQUARIE University
SYDNEY·AUSTRALIA

AI-ENABLED PROCESSES

https://aip-research-center.github.io/

Artificial intelligence (AI)

"A system's ability to correctly interpret **external** data, to learn from such data, and to use those learnings to achieve specific goals and tasks through flexible adaptation".



Kaplan, Andreas, and Michael Haenlein. "Siri, Siri, in my hand: Who's the fairest in the land? On the interpretations, illustrations, and implications of artificial intelligence." *Business Horizons* 62.1 (2019).

ARTIFICIAL INTELLIGENCE (AI)

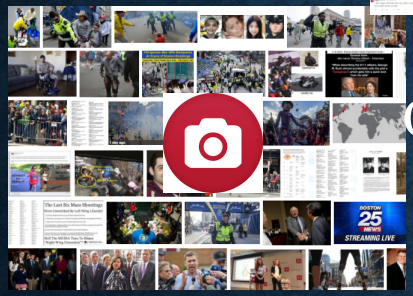
AI Components:

- **External** Data
  (From Data to **Big Data**)
- Learning
  (From **Machine Learning** and **Natural Language Processing** to Software-as-a-Service, Knowledge Graphs and Crowdsourcing)
- Goals and Tasks
  #Business-Process-Management #Decision-Making
  (Data-Driven and Knowledge-Intensive **Processes**)

Beheshti, et al., DataSynapse: A Social Data Curation Foundry (**DAPD Journal, 2018**)

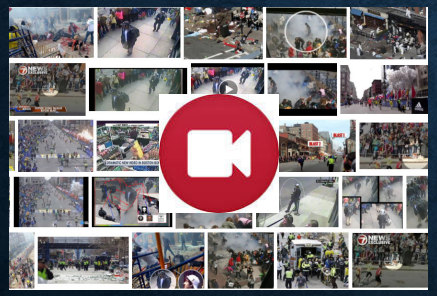
BIG DATA

Social Data



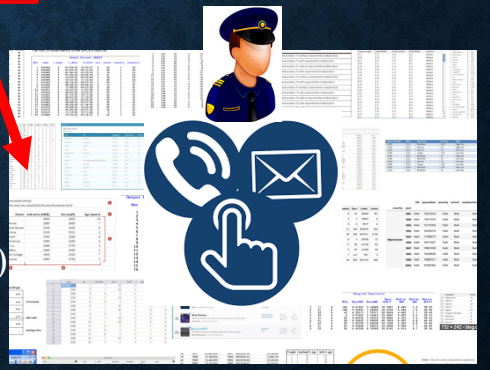
Open Data

Police Investigation



IoT Data

Private Data
(personal/business)



Beheshti et al. "ProcessAtlas: A scalable and extensible platform for business process analytics", Software: Practice and Experience, 2018

LEARNING

3 Different Types of AI Systems:

Analytical:

Learning based on past experience to inform future decisions

#process-automation #Business-Process #imitating-human-actions

Human-inspired:

Cognitive Assistants

#experience #decision-making #emotional-intelligence #knowledge-workers #imitating-human-judgment #rule-based #trainable #augmentation

Humanized Artificial Intelligence:

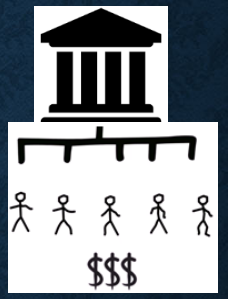
Self-conscious and Self-aware in interactions with others

#self-learning #intelligent #human-like-thought-processes

BUSINESS PROCESS (BP)

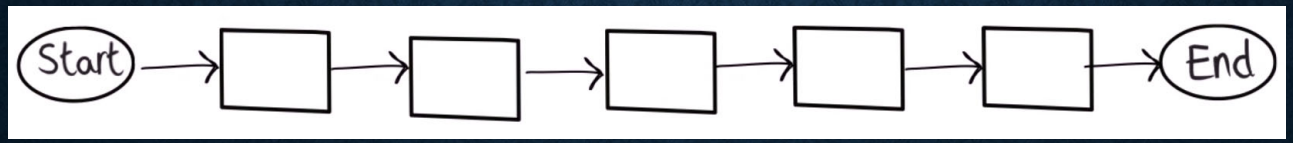
Business:

- Is an organization..
- A group of people that coordinate their work to create value $$



Process :

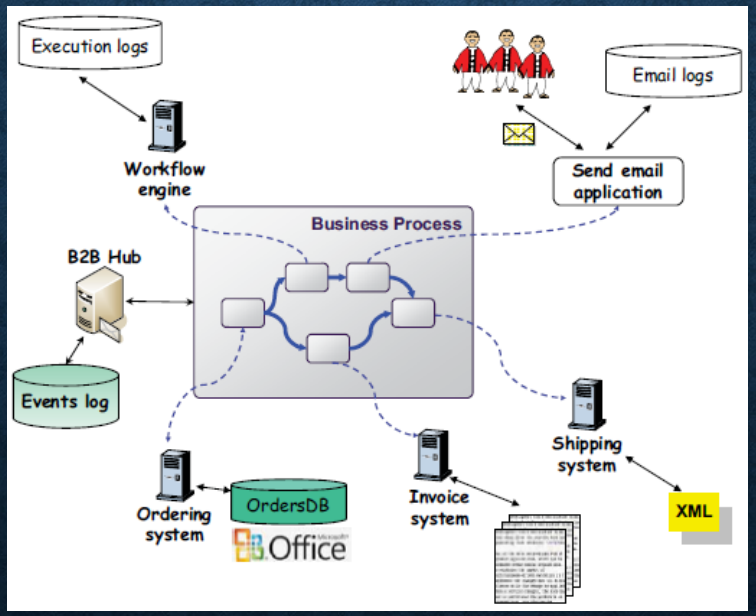
- A series of actions or steps taken in order to achieve a particular end.



BUSINESS PROCESS (BP)

Business Process :

is a set of coordinated tasks and activities, carried out (*manually* or *automatically*) to achieve a **business objective** or **goal**.



DATA-DRIVEN KNOWLEDGE-INTENSIVE PROCESSES

- Business world is getting increasingly dynamic.
- Information processing using knowledge-, service-, and cloud-based systems makes the use of complex, dynamic and often **knowledge-intensive** activities an inevitable task.

Police Investigation

Immigration

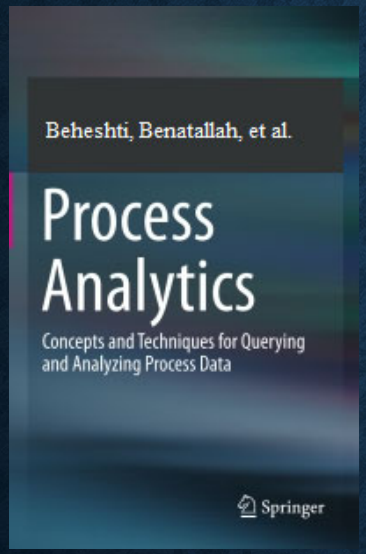
Budget Analysis

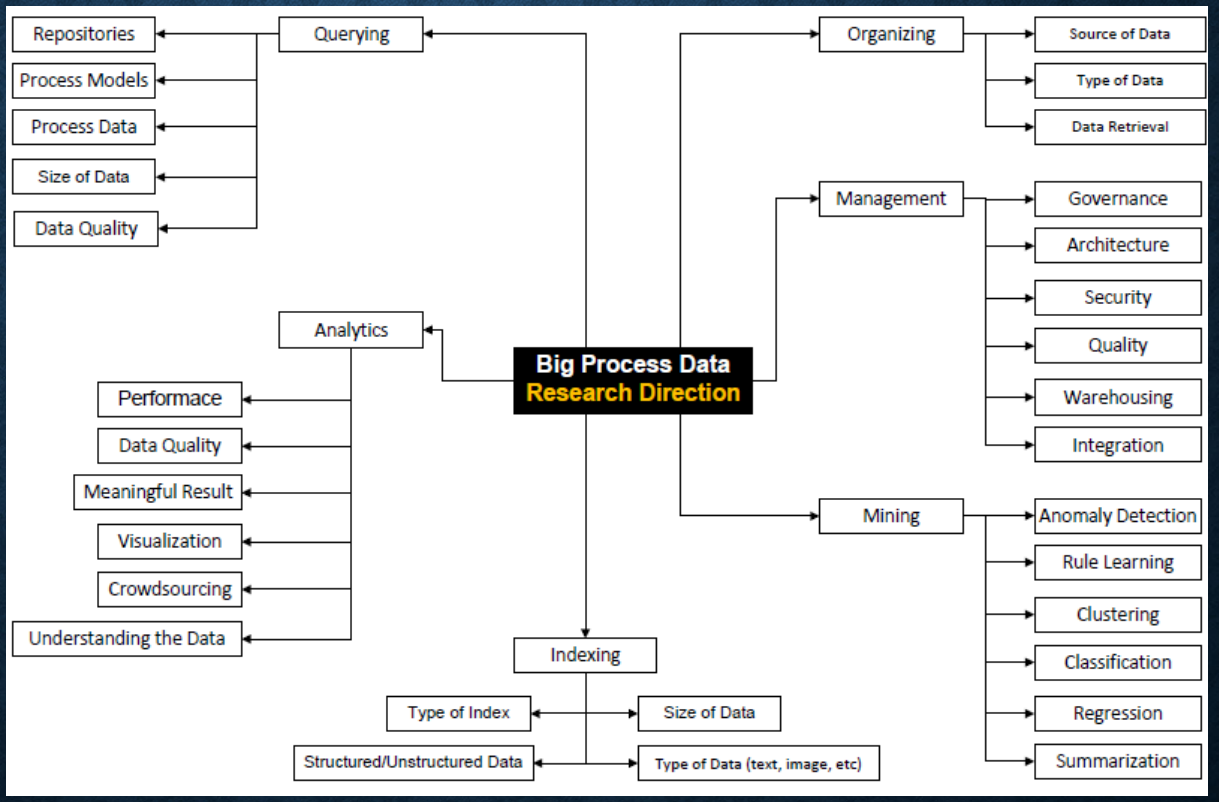
E-Safety

Education

Health

FROM STRUCTURED TO UNSTRUCTURED PROCESSES





https://www.springer.com/gp/book/9783319250366

PROCESS AUTOMATION / COGNITIVE ASSISTANT

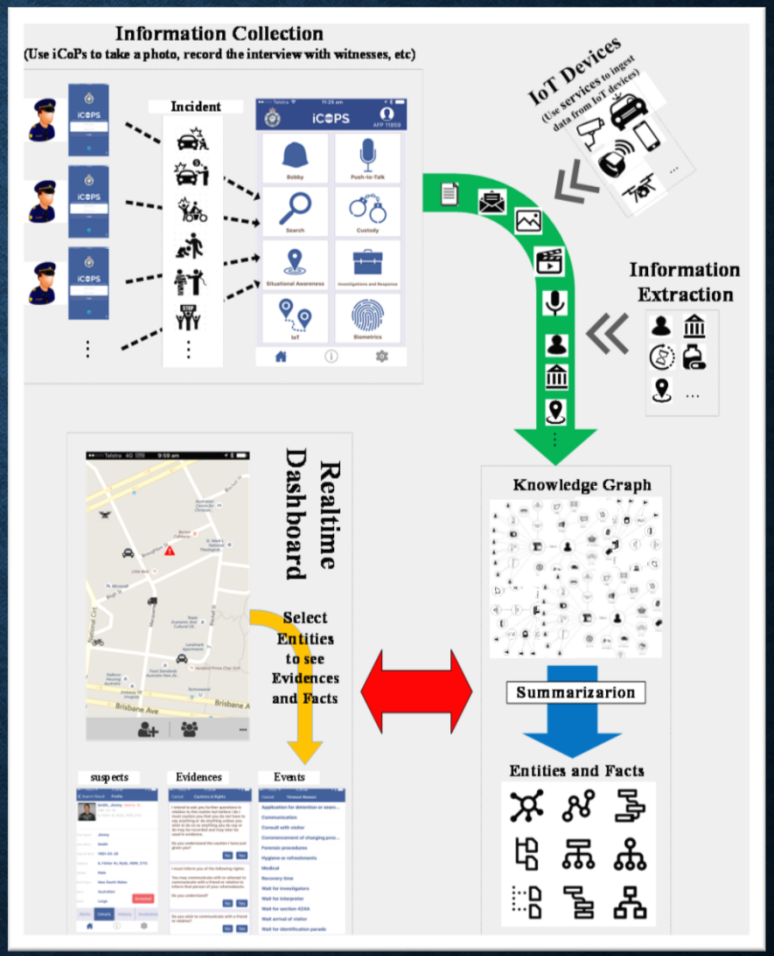
Motivating Scenario:
Missing Person !

In Australia, more than 38,000 people are reported missing each year.

https://missingpersons.gov.au/view-all-profiles

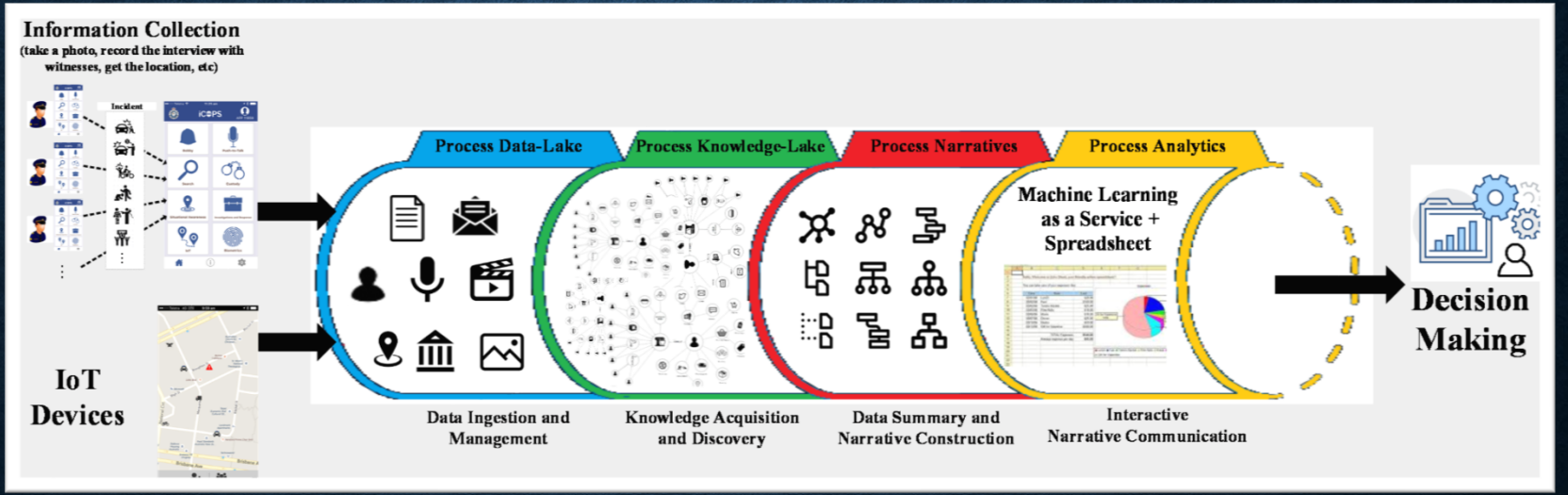
In USA, on any given day, there are as many as 100,000 active missing person's cases.

https://nij.gov



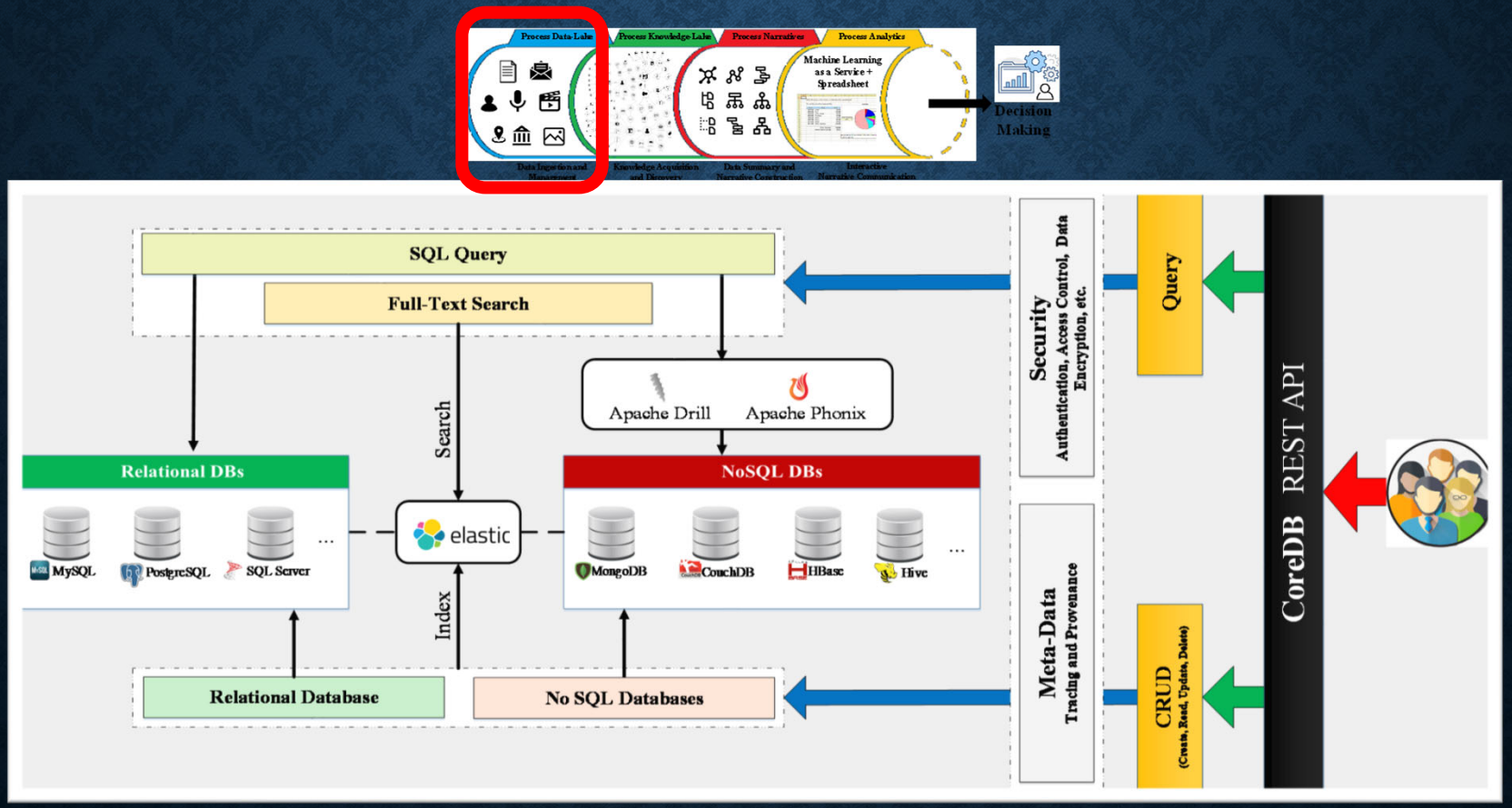
OUR SOLUTION

iProcess: a scalable and extensible IoT-Enabled Process Data Analytics Pipeline to enable analysts ingest data from IoT devices, extract knowledge from this data and link them to process execution data.

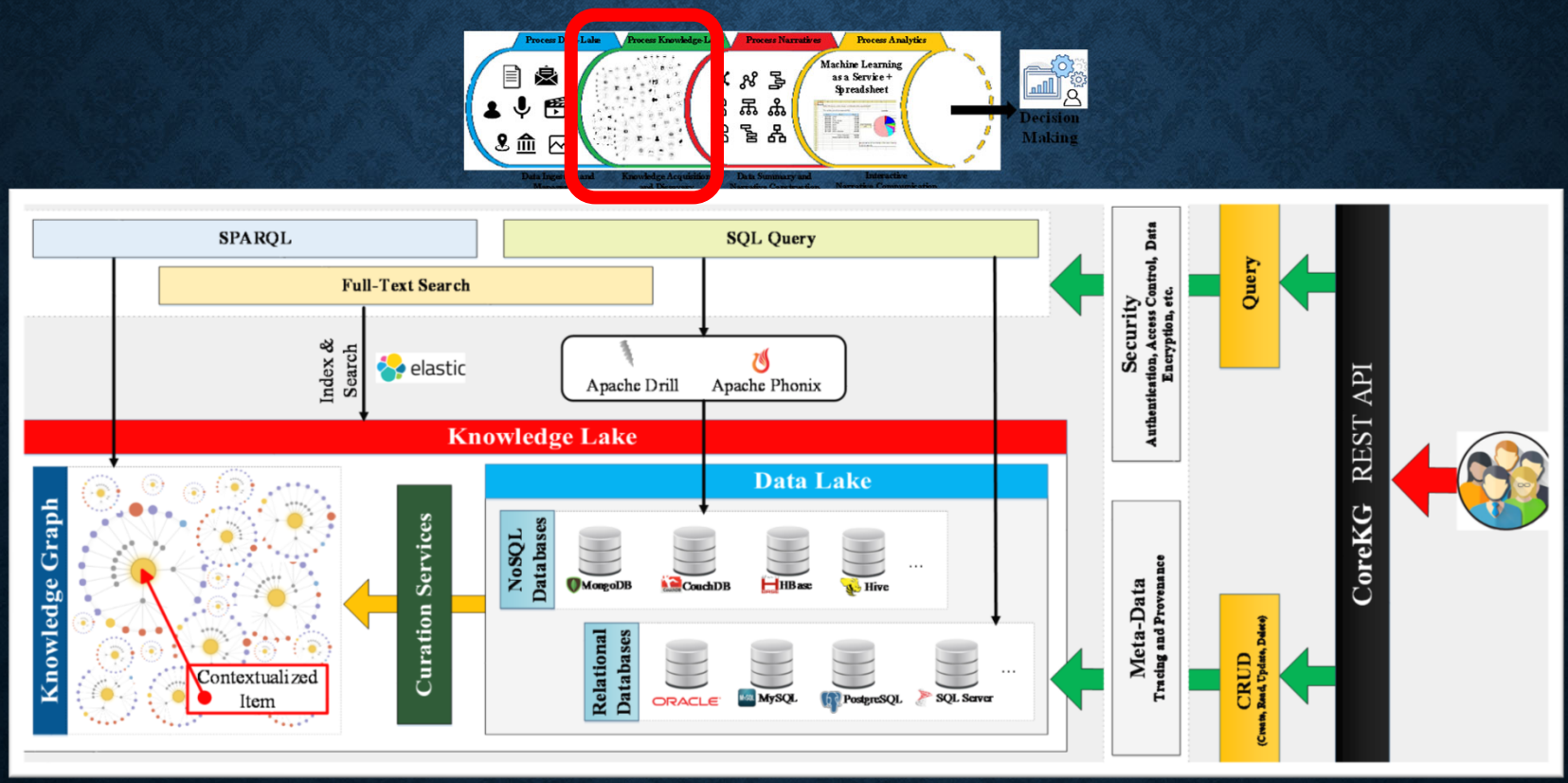


Beheshti, et al., "iProcess: Enabling IoT Platforms in Data-Driven Knowledge-Intensive Processes" BPM (Forum) 2018: 108-126

DATA LAKE AS A SERVICE



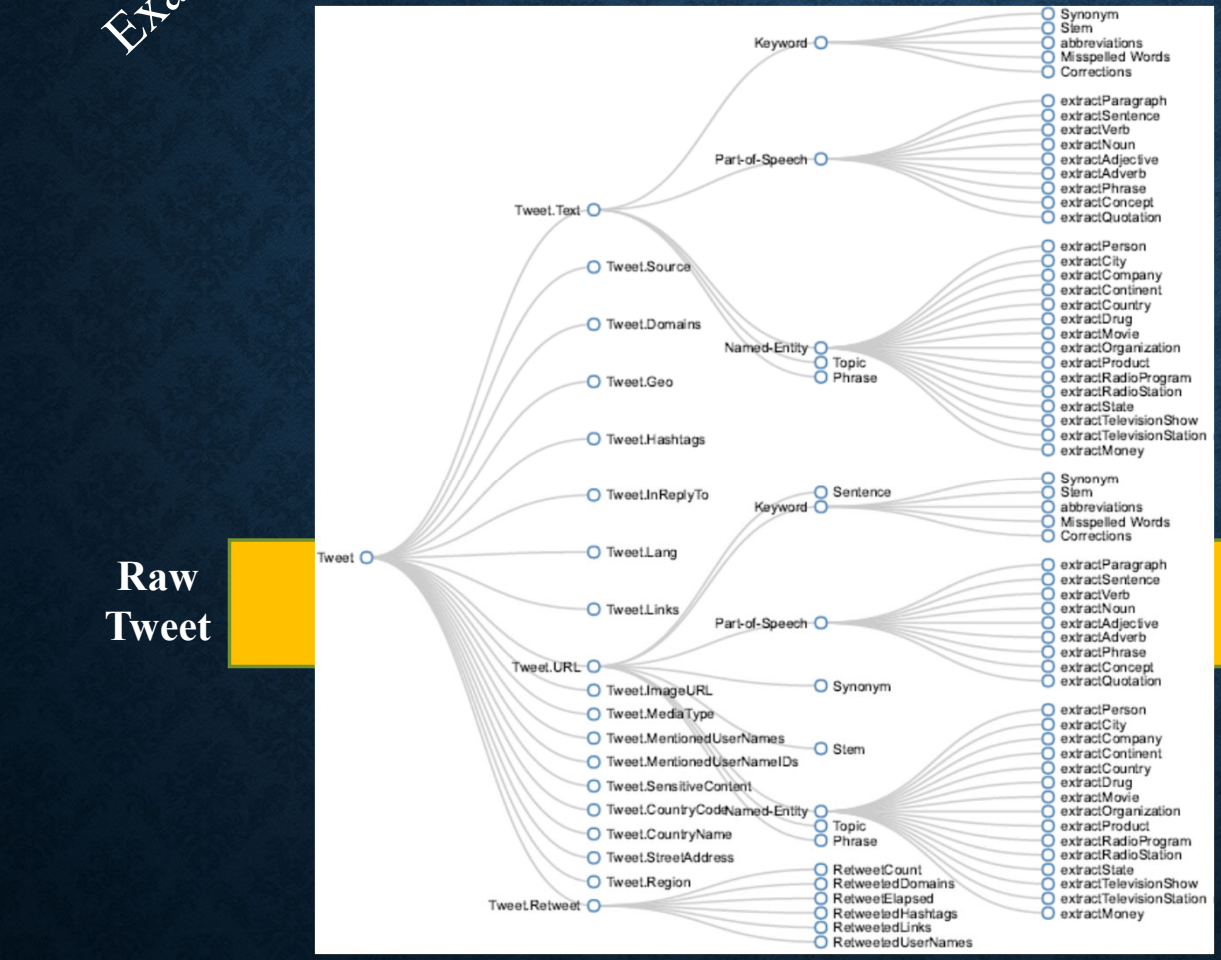
KNOWLEDGE LAKE AS A SERVICE



Beheshti, Benatallah, et al., **CoreKG: a Knowledge Lake Service (VLDB'18)** **https://github.com/unsw-cse-soc/CoreKG**
Beheshti, Benatallah, et al., DataSynapse: A Social Data Curation Foundry (**DAPD Journal, 2018**)

Example

Contextualized Item



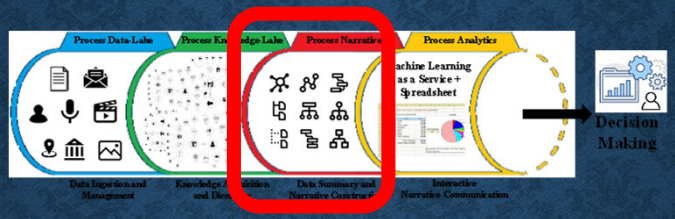
Raw Tweet

Contextualized Tweet

http://www.cse.unsw.edu.au/~sbeheshti/WWW17/

Beheshti et al., "On Automating Basic Data Curation Tasks", WWW, 2017

BIG DATA SUMMARIZATION



Process OLAP
Process Cubes
Dimensions
Cells
Measures
Operations

OLAP, is an approach to answering multi-dimensional analytical queries swiftly.

Problem:

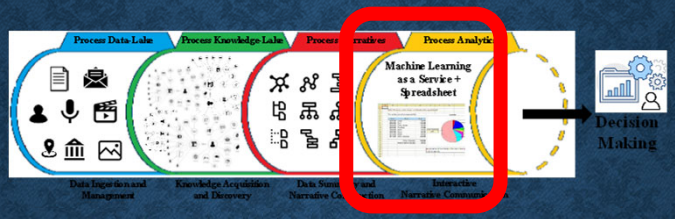
- extension of existing OLAP techniques to analysis of graphs is not straightforward.
- key business insights remain hidden in the interactions among objects.

Solution:

- On-Line Analytical Processing on Graphs

Beheshti et al., "**Scalable Graph-based OLAP Analytics over Process Execution Data**", Distributed and Parallel Databases (DAPD) Journal, 34(3), 379-423, 2016

ANALYTICS !

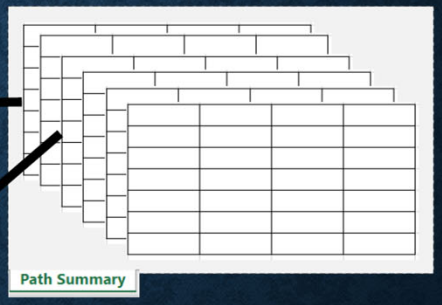


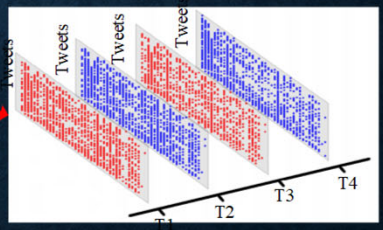
	A	B	C	D	E	F	G	H	I
2		Extracted-from	Data Islands						
3			Twitter	Facebook	eMail	Police Historical Data	news	CCTV1	...
4	D	person (named entity)	summary	summary	summary	summary	summary	summary	...
5	i	Location (named entity)	summary	summary	summary	summary	summary	summary	...
6	m	Organization (named							
7	e	...							
8	n	Keyword (missing)							
9	s	keyword (Police)							
10	i	keyword (crime)							
11	o	...							
12	n	Phrase (reported mis							
13	s	...							

Extracted-from (Relationsh

	A	B	C	D	E	F	G	H	I
1		IMAGE	Data Islands						
2			Twitter	Facebook	eMail	Police Historical Data	CCTV1	CCTV2	...
3	D	Time (captured)	summary	summary	summary	summary	summary	summary	...
4	i	Locaion (continent)	summary	summary	summary	summary	summary	summary	...
5	m	Locaion (Country)	summary	summary	summary	summary	summary	summary	...
6	e	Locaion (City)	summary	summary	summary	summary	summary	summary	...
7	n	Locaion (Suburb)	summary	summary	summary	summary	summary	summary	...
8	s	IP Address (captured)	summary	summary	summary	summary	summary	summary	...
9	i	source (mobile, PC, ...)	summary	summary	summary	summary	summary	summary	...
10	o	size	summary	summary	summary	summary	summary	summary	...
11	n	owner	summary	summary	summary	summary	summary	summary	...
12	s	...	...	...	...	...	...	...	...

Image (Entity Sumamry)



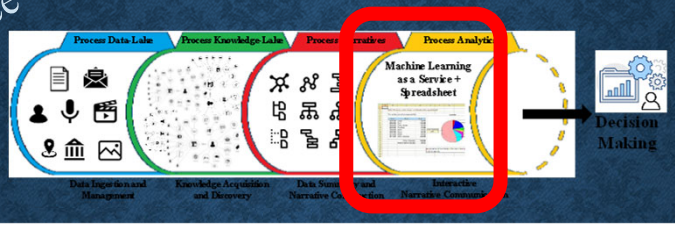


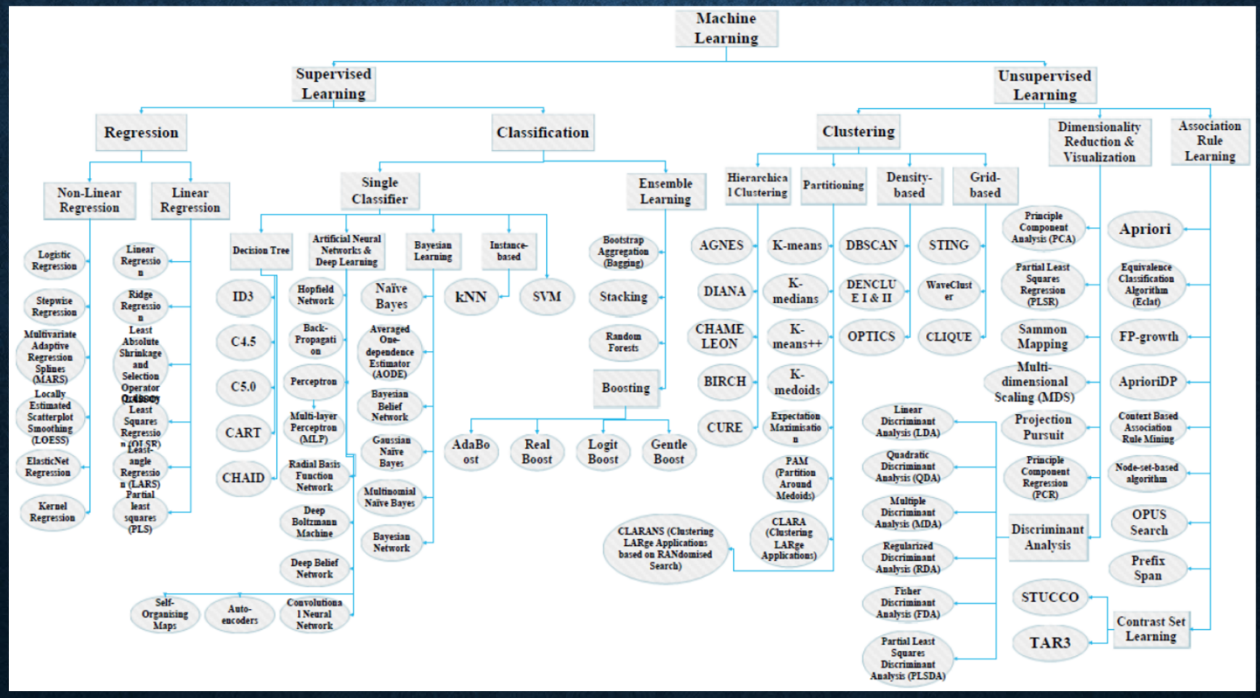
Data Analytics Research Lab

https://data-science-group.github.io/

ANALYTICS !

Machine Learning as a Service

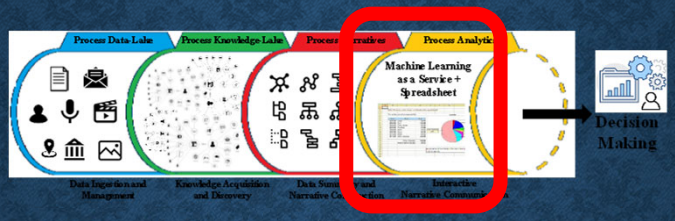




Data Analytics Research Lab

https://data-science-group.github.io/

ANALYTICS !



localhost | MLAAS

localhost:8080/

Formula Bar:

Dataset

group("location","time") Apply

	2016-04-01	2016-04-02	2016-04-03	2016-04-04	2016-04-05	2016-04-06	2016-04-07	2016-04-08	2016-04-09	2016-04-10
Brisbane	N/A	N/A	N/A	Tweets	Tweets	Tweets	N/A	N/A	N/A	N/A
Canberra	N/A	Tweets	N/A	N/A	N/A	N/A	N/A	Tweets	N/A	N/A
Melbourne	Tweets	N/A	N/A	Tweets	N/A	Tweets	N/A	N/A	N/A	Tweets
Perth	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Tweets	N/A
Sydney	Tweets	Tweets	Tweets	N/A	Tweets	Tweets	Tweets	Tweets	Tweets	N/A

classify.bytopic() Apply

	Sport	Politics	Business	Education	Entertainment
Sydney-2016-04-05	N/A	N/A	Tweets	N/A	N/A
Sydney-2016-04-06	N/A	N/A	Tweets	N/A	N/A
Sydney-2016-04-07	N/A	N/A	Tweets	N/A	Tweets

classify.bySentiment() Apply

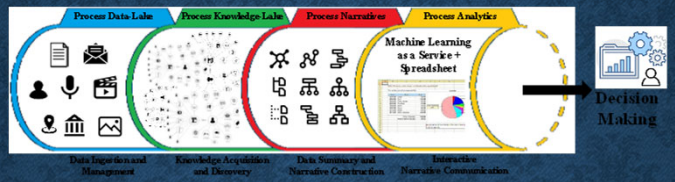
	Positive	Negative
Sydney-2016-04-07-Se	Tweets	Tweets

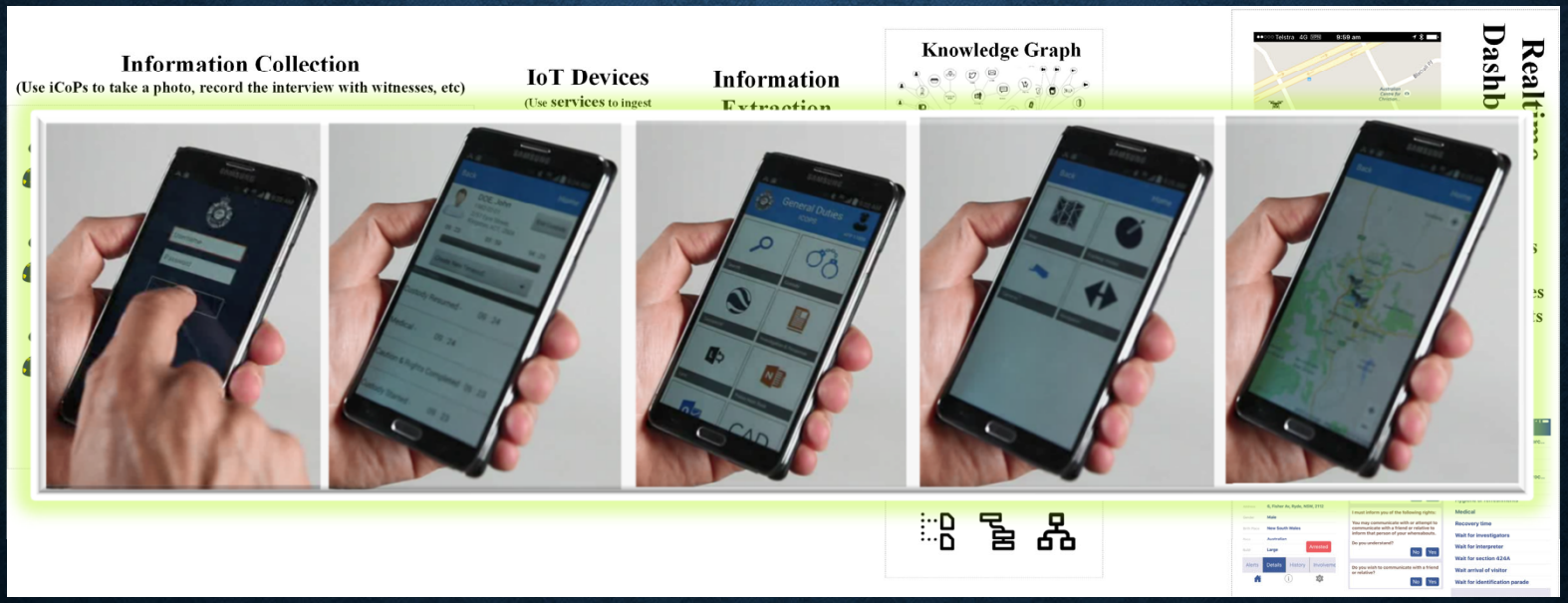
Twitter Group

ML as a Service

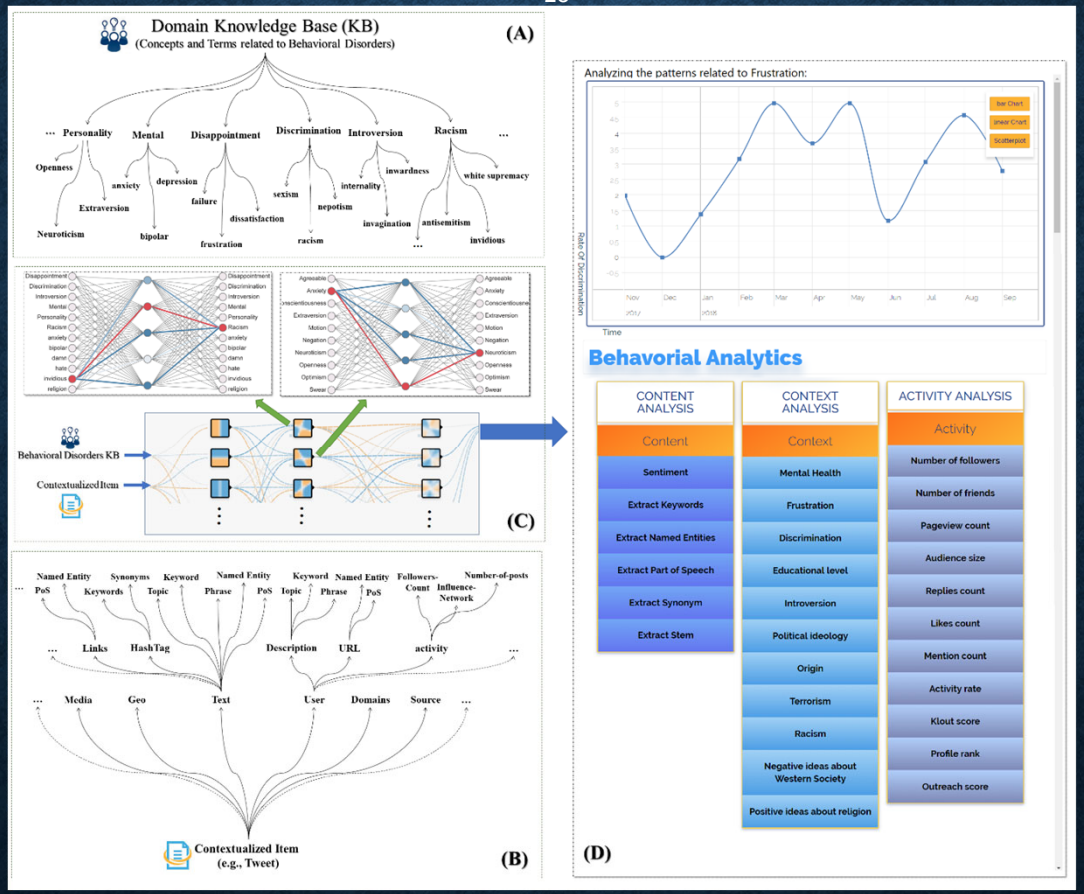
- − Classification
  - − SVM
  - − kNN
  - − Logistic Regression
  - − C5.0
  - − MLP
  - − Trained:Topic Classifier
  - − Trained:Sentiment Classifier
- + Clustering
- + Association Learning
- − Operations
  - − Select
  - − Group
  - − Sort
  - − Partition
  - − Addition

ANALYTICS !


Process Data Lake
Process Knowledge Lake
Process Narratives
Process Analytics
Machine Learning as a Service + Spreadsheet
Decision Making
Data Ingestion and Management
Knowledge Acquisition and Discovery
Data Summary and Narrative Construction
Interactive Narrative Communication

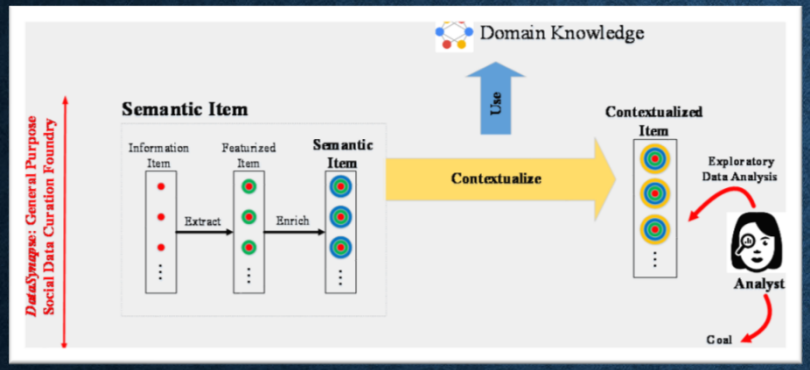

Information Collection
(Use iCoPs to take a photo, record the interview with witnesses, etc)
IoT Devices
(Use services to ingest
Information
Knowledge Graph
Dashb
Realtim

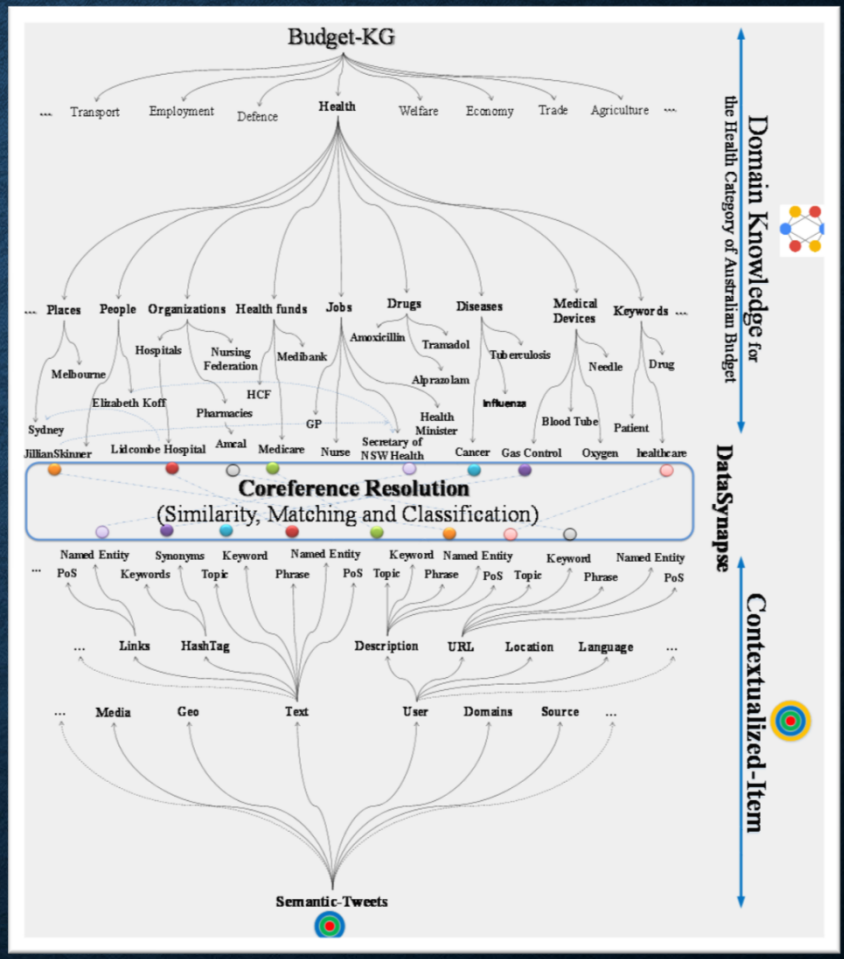
AI-ENABLED PROCESSES (E-SAFTEY)



Beheshti et al., "personality2vec: Enabling the Analysis of Behavioral Disorders in Social Networks", 13th ACM International WSDM Conference (WSDM), Houston, Texas, USA, 2020. (ERA Rank: A*)

AI-ENABLED PROCESSES (BUDGET)

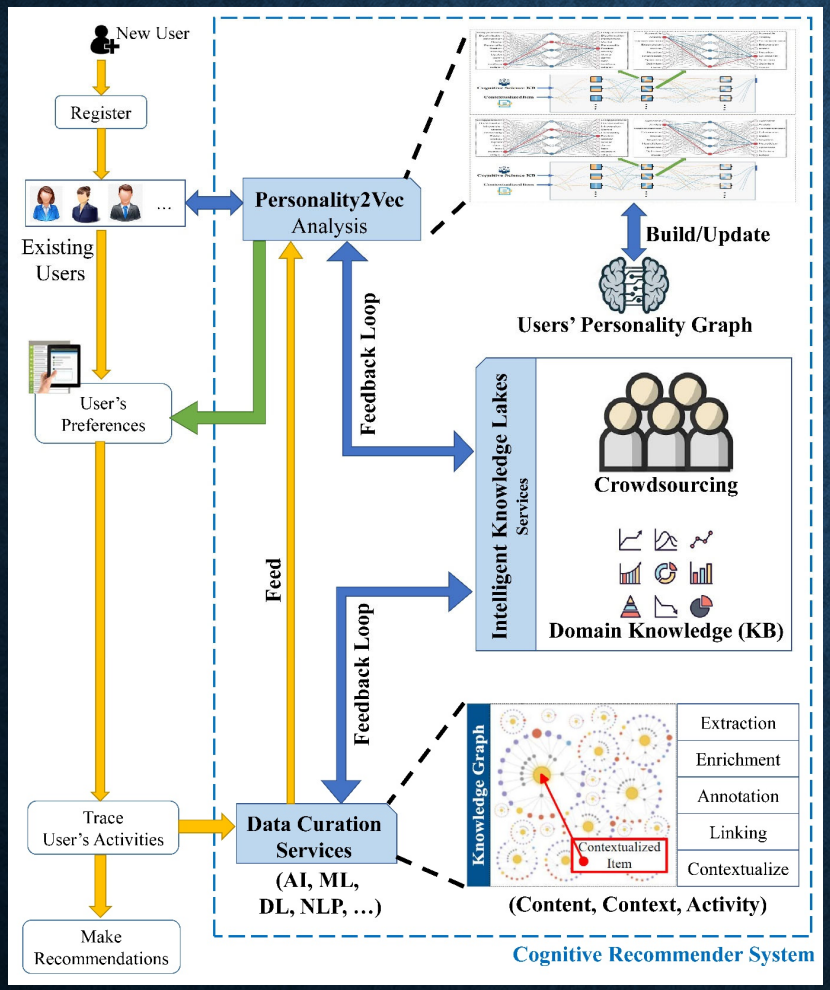




Motivating Example:
A typical scenario for analyzing Urban Social Issues from Twitter as it relates to the Government Budget, to highlight how DataSynapse significantly improves the quality of extracted knowledge compared to the classical curation pipeline (in the absence of feature extraction, enrichment and domain-linking contextualization).

Beheshti et al., "DataSynapse: A Social Data Curation Foundry". Distributed and Parallel Databases (DAPD) Journal, 2018

COGNITIVE RECOMMENDER SYSTEMS



•Beheshti et al., "Towards **Cognitive Recommender Systems**", Algorithms Journal, 2020

TCS AND MQ *LARGE RESEARCH GRANT !*

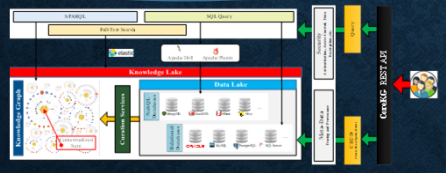
MACQUARIE University
SYDNEY·AUSTRALIA

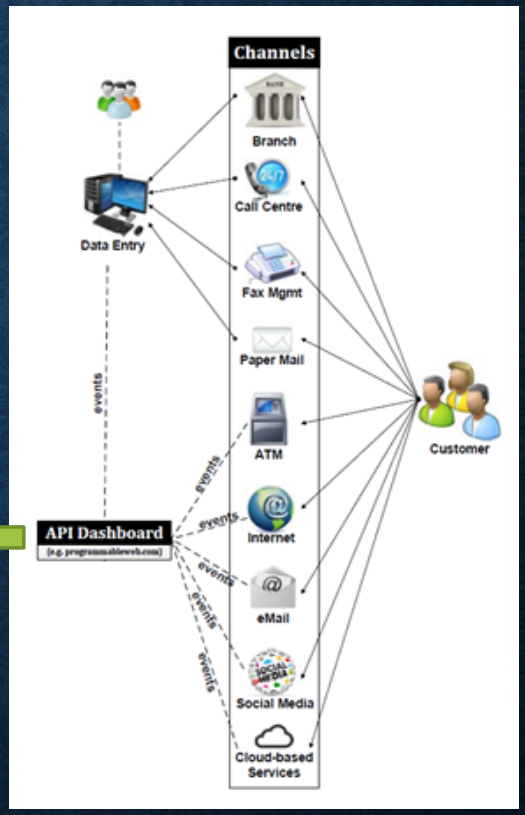
TATA
TATA CONSULTANCY SERVICES

- Fraud detection
- Customer segmentation
- Managing customer data
- Intelligent Recommendation
- Personalized banking
- Real-time and predictive analytics
- Risk modeling for investment banks
- …

- *Automation*
- *Cognitive Assistants*

Intelligent Knowledge Lake





https://www.linkedin.com/posts/amin-beheshti-07118919_it-is-my-great-pleasure-to-lead-a-strategic-activity-6643807285191720960-oUF3

AI-ENABLED BANKING HACKATHON

BIG DATA SOCIETY
DATA ANALYTICS RESEARCH LAB
MACQUARIE UNIVERSITY, SYDNEY, AUSTRALIA
December 9-10, 2020

SPONSORS

TATA CONSULTANCY SERVICES
Diamond Sponsor

Research Centre
Diamond Sponsor

PARTICIPANTS

Westpac
Participant

MACQUARIE University
SYDNEY·AUSTRALIA

SPONSORS PARTICIPANTS

TATA CONSULTANCY SERVICES Diamond Sponsor

aip Research Centre Diamond Sponsor

Westpac Participant

HACKATHON CHALLENGES

Challenge 1: Anomaly Detection

This challenge will be algorithmic and will target participants **with a Computer/Data Science background**. Participants will develop a learning system to perform an intelligent fraud detection method for detecting risky users in the banking systems.

- Your solution should help understanding patterns of anomalies by contextualizing and analysing the Credit Card Data.

Dataset:

https://www.kaggle.com/mlg-ulb/creditcardfraud

Copyright © DataAnalyticsResearchLab @MQ

MACQUARIE University
SYDNEY·AUSTRALIA

SPONSORS PARTICIPANTS

TATA CONSULTANCY SERVICES Diamond Sponsor

aip Research Centre Diamond Sponsor

Westpac Participant

HACKATHON CHALLENGES

Challenge 2: Customer Journey

This challenge will focus on building a software prototype (UI) and will target participants **without a coding background.** Participants will develop a prototype for a cognitive assistant for a ***Business Analyst*** in banking.

- You will design a Software Prototype (for a mobile App) that can assist a business analyst to facilitate understanding and analyzing the customer experience, i.e., the sum of all interactions a customer perceives along the entire customer journey when interacting with a bank or financial institution.

Copyright © DataAnalyticsResearchLab @MQ

MACQUARIE University
SYDNEY·AUSTRALIA

SPONSORS PARTICIPANTS

TATA CONSULTANCY SERVICES Diamond Sponsor

aip Research Centre Diamond Sponsor

Westpac Participant

HACKATHON CHALLENGES

Challenge 3: Cognitive Recommender Systems

This challenge will focus on building a software prototype (UI) and will target participants **without a coding background.** Participants will develop a prototype for a cognitive assistant for a ***Banking Customer***.

- You will design a Software Prototype (for a mobile App) that can assist banking customers better understand the services provided by a bank or a financial institution, and help them to intelligently choose the right products.

Ref:
Beheshti et al., "Towards **Cognitive Recommender Systems**", Algorithms Journal, 2020
Download: https://www.mdpi.com/1999-4893/13/8/176

Copyright © DataAnalyticsResearchLab @MQ

Thank You

"Australia is a world leader in the quality of research but falls behind when it comes to commercialising good ideas and collaborating with industry"
Minster for Education, Simon Birmingham

Let us take the "External Research Partnership" in Australia, to the next level.