

The Future of Intelligence

Kristian Hammond

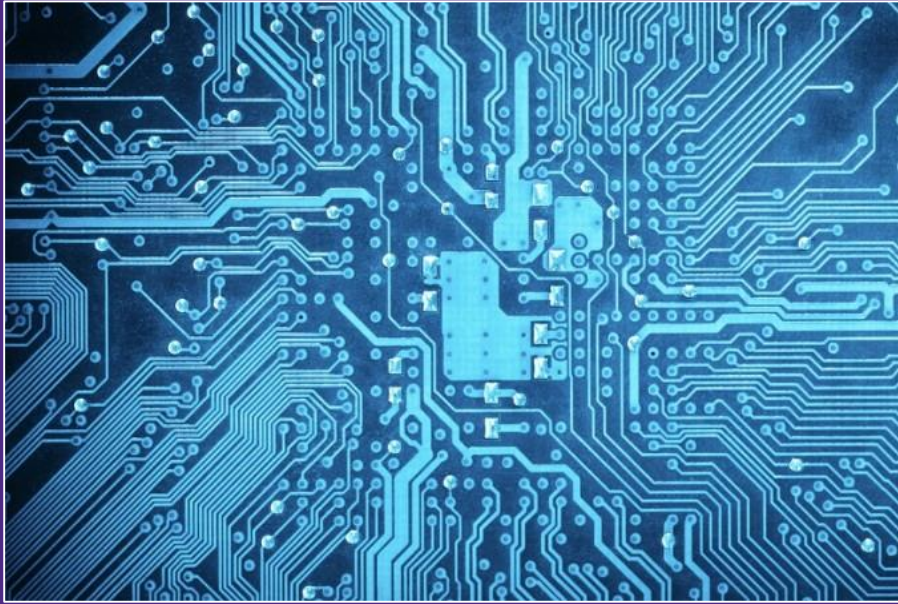
Northwestern | McCORMICK SCHOOL OF ENGINEERING

Electrical Engineering & Computer Science

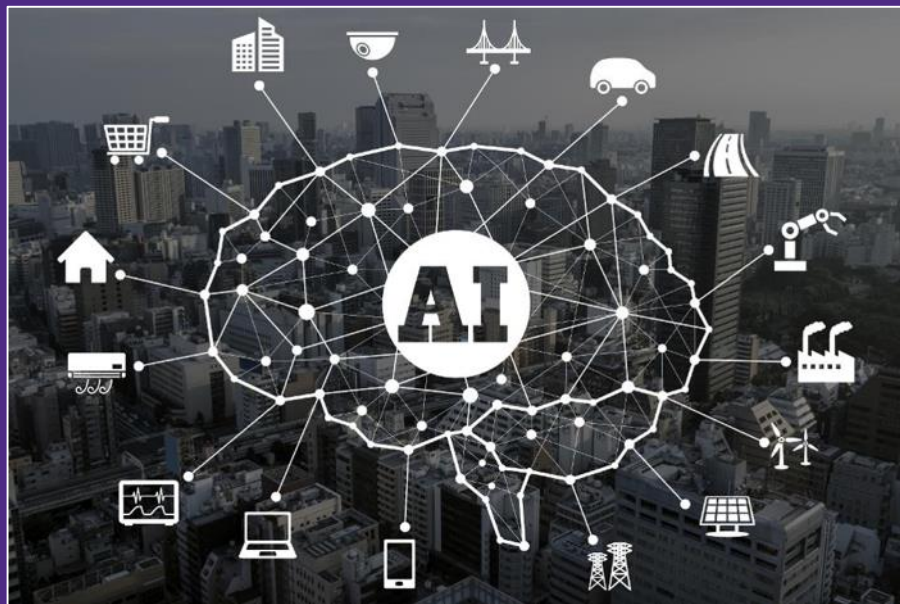
Professor, Computer Science

narrative  science

Chief Scientist, Co-Founder



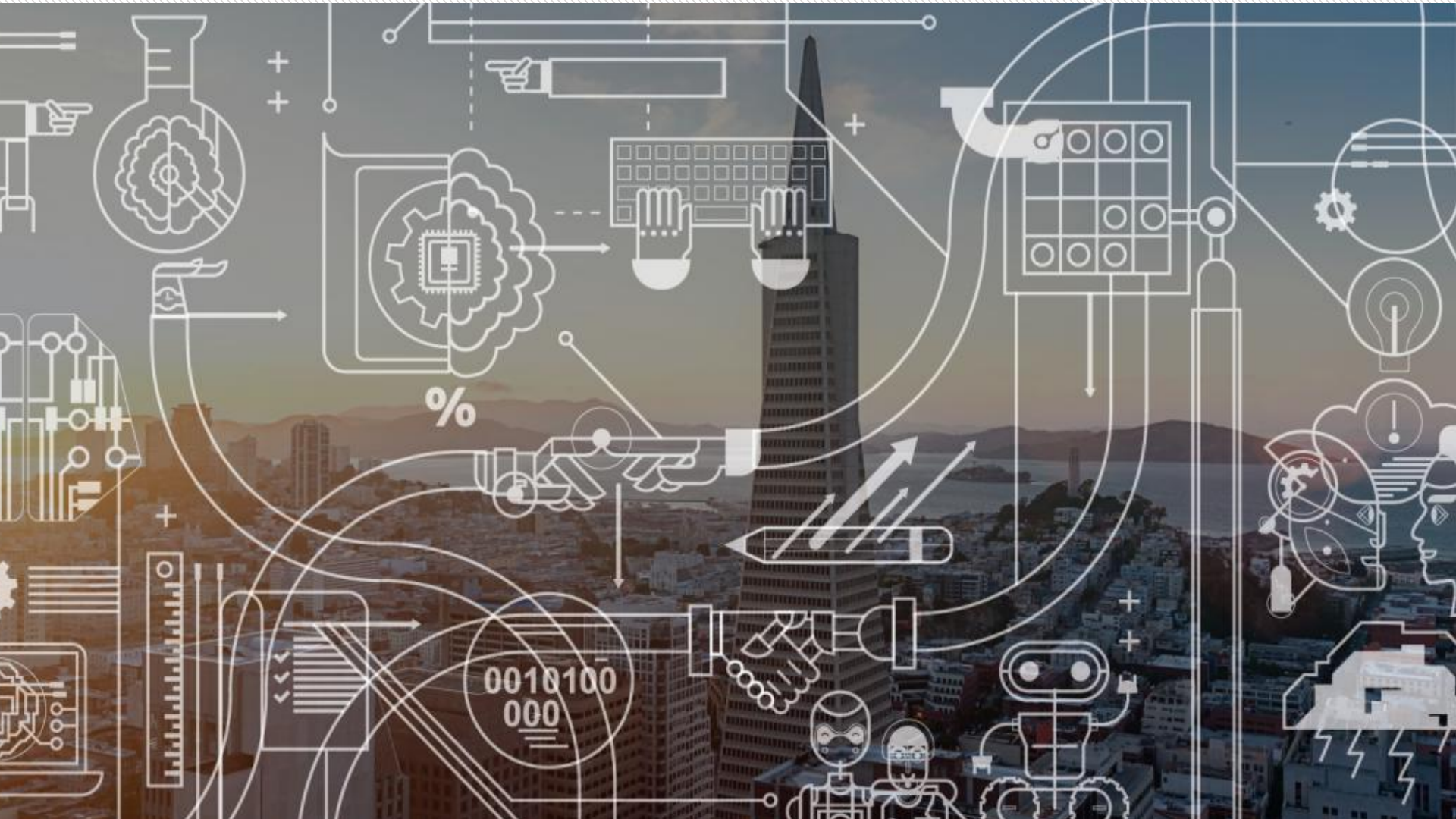
Computers are
already
everywhere



Artificial
Intelligence is
soon to be
everywhere

Ten years ago

AI for the enterprise was
unthinkable





The machine's world

Router Data
Passwords
Utilization logs
Up time
Psychographics
Types of stories
Sales
Education
Health
Census
Traffic
Actions
Outcomes
Sports
War
Drug effects
Drug effectiveness
Salaries
Stocks
History
Your searches
Searches
Pages Viewed
Transactions
Network Utilization
Application Use
Punishment
Your car
Your home
Jobs
Housing
Your DNA
Emigration
Crimes



2.5 Zetabytes of
data are produced
every day



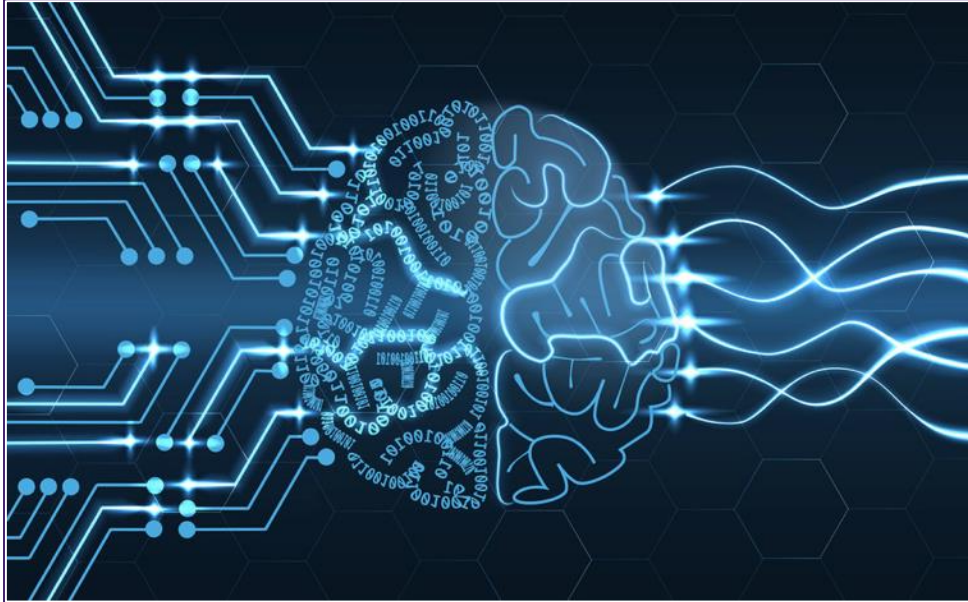
250,000 Libraries
of Congress,
every day



Spreadsheets

451	368	60	46	83	74
39	164	94	45	73	38
235	166	172	54	91	85
			10	30	62
433	896	2.132	2.390	3.850	2.175
.870	2.845	1.001	1.920	1.748	2.387
2.427	1.133	1.308	3.928	3.176	2.514
2.424	2.697	1.710	1.287	1.272	2.3
1.692	1.844	1.725	2.110	1.928	
1.199	1.903	1.442	3.292	3.395	
2.032	1.198	2.453	1.272	1.9	
290	92	266			
243	430	159			
249	277	324			
	175	35			





Systems that work with people need to integrate analysis and reasoning with communication

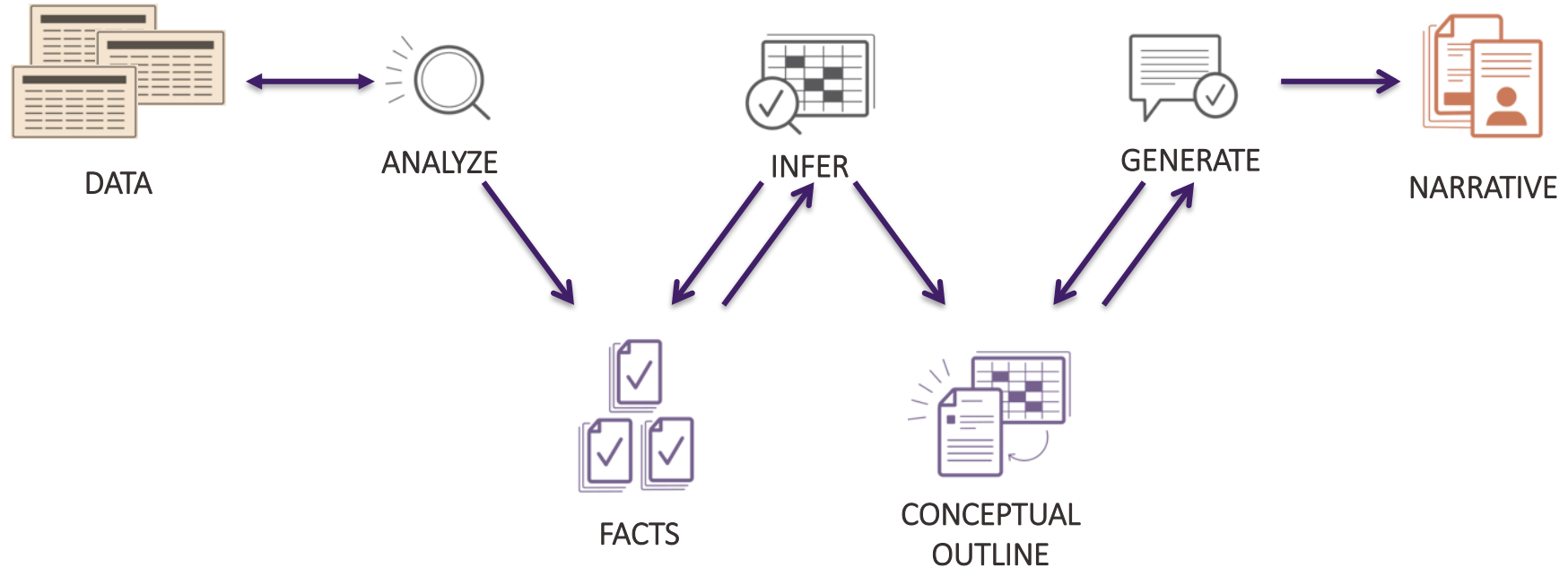
Advanced NLG

Quarter	Product	Sales
Q1		
Q2		
Q3	ID_0078	ID_0078
Q4	ID_0078	\$1,850,000

While still slightly better than sales of the small light widget, sales of the overly large widget have been on the decline over the last year. During the same period, sales of the small light widget have been steadily improving.



Advanced Natural Language Generation



A person with short, light-colored hair, wearing a light-colored striped shirt, is seen from behind, sitting at a desk. The desk is cluttered with several computer monitors. The monitors display various types of data: some show line graphs, others show bar charts, and some show tables of data. The person's right hand is on a mouse. On the desk, there is also a keyboard, a multi-line office phone, a small bottle of hand sanitizer, and some papers. The background shows more computer equipment and a typical office environment.

Information instead
of data

[illegible]

010101000101101001011001001110001C
1110101000101101001011001001110001
101010101010001011010010110010C
000101110101000101101001011001C

- Macroeconomic Data
- Portfolio Data
- Risk Data
- Returns Data

An IPC that reads better than human



QUILL™ PORTFOLIO

International Growth

The International Growth Fund generated returns of 1.2% over the quarter ending June 28, 2013, outperforming the benchmark by 0.1 percentage points (bp). Stock selection and security selection contributed to the outperformance against the MSCI EAFE Index.

Relative to the benchmark, the Fund's overweight position in the Consumer Discretionary sector and stock selection within the Consumer Staples sector contributed to returns. The Fund's larger exposure to Pigeon Corporation was a driver of the Fund's outperformance in the Consumer Staples sector, and the allocation to JP Holdings, Inc. provided a significant boost to relative returns in the Consumer Discretionary sector. JP Holdings, Inc. increased 45.63% during the quarter, while the benchmark was flat.

On a relative basis, stock selection in the Financials sector contributed to returns over the quarter. Specifically, the Fund's overweight position in Japan-based Tokyo Tatemono Co. hindered performance as the stock had a down quarter.

On a country basis, the United Kingdom was the top performer in relative performance. Stock selection was the driver of performance in the region, and Rightmove PLC was the top UK contributor.

The Fund's underweight allocation to Australia also contributed to relative returns. The Fund's exposure to Canada and the Netherlands detracted from relative returns.

Top Influencers

- The Fund's overweight position in the Consumer Discretionary sector contributed to relative performance.
- Overweight positions in Rightmove PLC and Keller Group helped drive performance in the United Kingdom.
- Chicago Bridge & Iron Co. detracted from the Fund's returns in the Netherlands.
- On a sector basis, the Fund's overweight positions in European

to the portfolio was Air Canada. This security alone contributed 0.32 to the

Relative to the benchmark, the Fund's allocation to the Consumer Discretionary sector and stock selections within Consumer Staples contributed to overall return.

The fund's overweight position in Japan-based Tokyo Tatemono Co. hindered performance as the stock had a down quarter.

Overweight positions in Rightmove and Keller Group helped drive performance in the United Kingdom.

Return Contribution to Fund

- Air Canada: -0.28
- Chicago Bridge & Iron: -0.24
- Tokyo Tatemono Co.: -0.21

Democratizing
information



Data on the quality of our water

BeachName	Timestamp	WaterTemperature	Turbidity	TransducerDepth	WaveHeight	WavePeriod	BatteryLife	MeasurementID	
MontroseBeach	8/30/13:00	20.3	1.18	0.891	0.08	3	9.4	MontroseBeach201308300800	
OhioStreetBeach	5/26/16:3:00	14.4	1.23		0.111	4	12.4	OhioStreetBeach201605261300	
CalumetBeach	9/3/13:16:00	23.2	3.63	1.201	0.174	6	9.4	CalumetBeach201309031600	
CalumetBeach	5/28/14:2:00	16.2	1.26	1.514	0.147	4	11.7	CalumetBeach201405281200	
MontroseBeach	5/28/14:12:00	14.4	3.36	1.388	0.298	4	11.9	MontroseBeach201405281200	
MontroseBeach	5/28/14:13:00	14.5	2.72	1.395	0.306	3	11.9	MontroseBeach201405281300	
CalumetBeach	5/28/14:14:00	16.3	1.28	1.524	0.162	4	11.7	CalumetBeach201405281300	
MontroseBeach	5/28/14:14:00	14.8	2.97	1.386	0.328	3	11.9	MontroseBeach201405281400	
CalumetBeach	MontroseBeach	8/30/13:00	20.3	1.18	0.891	0.08	3	9.4	MontroseBeach201308300800
CalumetBeach	MontroseBeach	OhioStreetBeach	5/26/16:3:00	14.4	1.23	0.111	4	12.4	OhioStreetBeach201605261300
CalumetBeach	CalumetBeach	9/3/13:16:00	23.2	3.63	1.201	0.174	6	9.4	CalumetBeach201309031600
MontroseBeach	CalumetBeach	5/28/14:2:00	16.2	1.26	1.514	0.147	4	11.7	CalumetBeach201405281200
CalumetBeach	MontroseBeach	5/28/14:12:00	14.4	3.36	1.388	0.298	4	11.9	MontroseBeach201405281200
MontroseBeach	MontroseBeach	5/28/14:13:00	14.5	2.72	1.395	0.306	3	11.9	MontroseBeach201405281300
MontroseBeach	CalumetBeach	5/28/14:14:00	16.3	1.28	1.524	0.162	4	11.7	CalumetBeach201405281300
CalumetBeach	MontroseBeach	5/28/14:14:00	14.8	2.97	1.386	0.328	3	11.9	MontroseBeach201405281400
MontroseBeach	CalumetBeach	5/28/14:15:00	16.8	1.31	1.568	0.196	4	11.7	CalumetBeach201405281500
MontroseBeach	MontroseBeach	5/28/14:15:00	14.5	4.3	1.377	0.328	3	11.9	MontroseBeach201405281500
CalumetBeach	CalumetBeach	5/28/14:16:00	17.1	1.37	1.52	0.194	4	11.7	CalumetBeach201405281600
MontroseBeach	MontroseBeach	5/28/14:16:00	14.4	4.87	1.366	0.341	3	11.9	MontroseBeach201405281600
CalumetBeach	CalumetBeach	5/28/14:17:00	17.2	1.48	1.525	0.203	4	11.7	CalumetBeach201405281700
MontroseBeach	MontroseBeach	5/28/14:17:00	14.1	5.06	1.382	0.34	4	11.9	MontroseBeach201405281700
CalumetBeach	MontroseBeach	5/28/14:18:00	14.2	5.76	1.415	0.356	3	11.9	MontroseBeach201405281800
MontroseBeach	CalumetBeach	5/28/14:18:00	17.1	1.8	1.501	0.188	4	11.7	CalumetBeach201405281800
CalumetBeach	CalumetBeach	5/28/14:19:00	17	1.82	1.487	0.194	4	11.7	CalumetBeach201405281900
CalumetBeach	MontroseBeach	5/28/14:19:00	14.2	6.32	1.386	0.346	3	11.9	MontroseBeach201405281900
MontroseBeach	MontroseBeach	5/28/14:20:00	14.4	6.89	1.401	0.38	4	11.9	MontroseBeach201405282000
MontroseBeach	CalumetBeach	5/28/14:20:00	17	1.83	1.488	0.196	4	11.7	CalumetBeach201405282000
CalumetBeach	MontroseBeach	5/28/14:21:00	14.5	7.13	1.374	0.361	5	11.9	MontroseBeach201405282100
CalumetBeach	CalumetBeach	5/28/14:21:00	16.8	1.9	1.494	0.181	4	11.7	CalumetBeach201405282100
MontroseBeach	MontroseBeach	5/28/14:22:00	14.5	6.88	1.413	0.345	4	11.9	MontroseBeach201405282200
CalumetBeach	CalumetBeach	5/28/14:22:00	16.7	1.83	1.467	0.18	4	11.7	CalumetBeach201405282200
MontroseBeach	MontroseBeach	5/28/14:23:00	14.3	7.32	1.406	0.331	4	11.9	MontroseBeach201405282300
MontroseBeach	CalumetBeach	5/28/14:23:00	16.5	1.69	1.548	0.177	4	11.7	CalumetBeach201405282300
	CalumetBeach	5/29/14:1:00	16.3	1.62	1.519	0.159	4	11.7	CalumetBeach201405290100
	MontroseBeach	5/29/14:1:00	14.2	7.18	1.46	0.305	4	11.9	MontroseBeach201405290100
	MontroseBeach	5/29/14:2:00	14.2	6.35	1.45	0.321	3	11.9	MontroseBeach201405290200
	CalumetBeach	5/29/14:2:00	16.2	1.57	1.535	0.154	4	11.7	CalumetBeach201405290200
	CalumetBeach	5/29/14:3:00	16.1	1.8	1.557	0.163	4	11.7	CalumetBeach201405290300
	MontroseBeach	5/29/14:3:00	14.1	6.78	1.468	0.285	4	11.8	MontroseBeach201405290300
	CalumetBeach	5/29/14:3:00	16.1	1.82	1.507	0.156	4	11.7	CalumetBeach201405290400
	MontroseBeach	5/29/14:3:00	14.1	6.27	1.456	0.306	3	11.8	MontroseBeach201405290400
	MontroseBeach	5/29/14:5:00	14	5.63	1.421	0.282	3	11.8	MontroseBeach201405290500

Temperature

Time and Date

Wave Height

Turbidity

Understandable information



Chicago Beaches: July 16, 2016

Best Bet

For the week ending July 16, 2016, 63rd Street Beach was the cleanest beach in Chicago, as measured by the cloudiness of the water. This beach also happened to be the warmest, with an average temperature of 19.1° C.

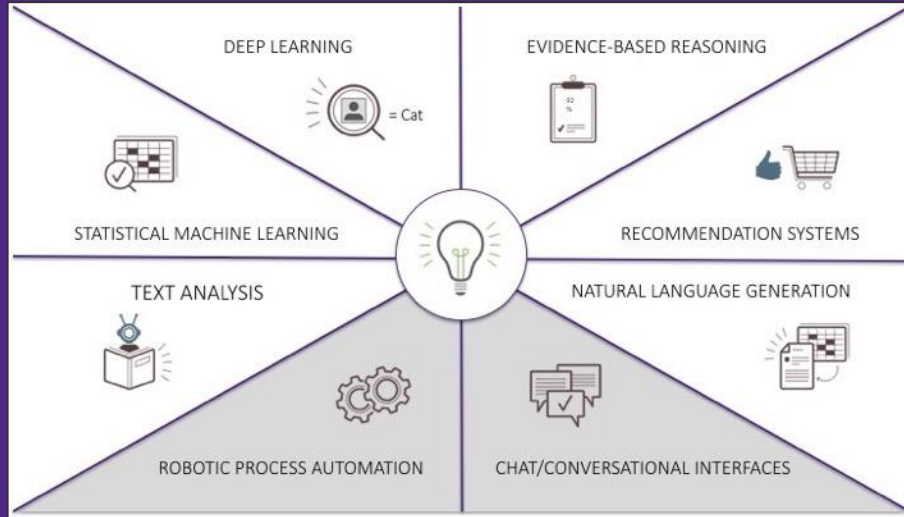
63rd Street Beach was the calmest throughout the entire week, with an average wave height of 0.12 meters. This beach also happened to be the warmest, with an average temperature of 19.1° C.

For the week ending July 16, 2016, 63rd Street Beach was the cleanest beach in Chicago, as measured by the cloudiness of the water...

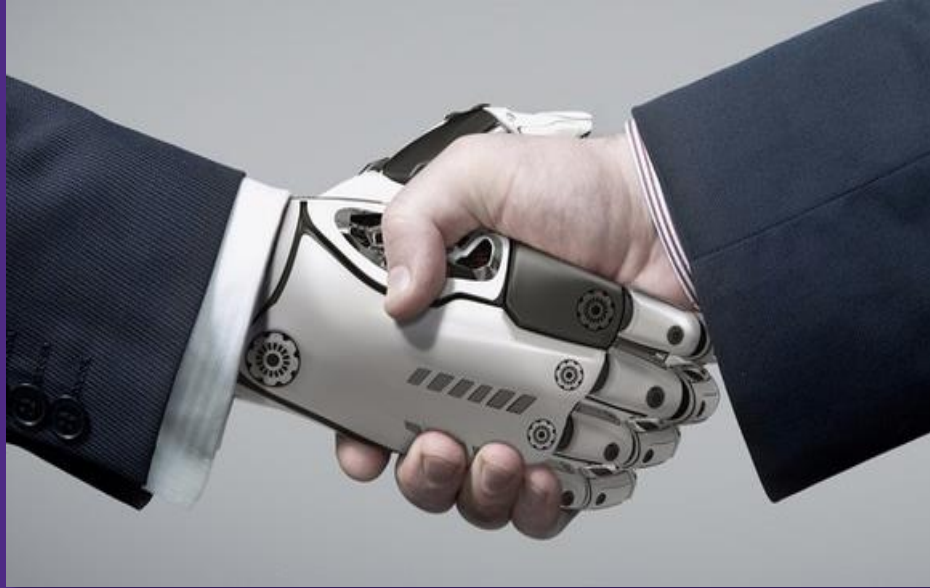
Ohio Street Beach was the dirtiest beach in Chicago...

Ohio Street Beach was the dirtiest beach in Chicago, as measured by the overall turbidity of the water (average NTU 1.22). Ohio Street Beach did not record the highest turbidity rating of the week, however. For the week ending July 16, 2016, the highest turbidity rating was recorded around 1 PM. In addition, Ohio Street Beach was also the coldest beach in Chicago, with an average temperature of 18.1° C. Beachgoers would be advised to visit Oak Street beach that had a better than average cleanliness rating...

Beachgoers would be advised to visit Oak Street beach that had a better than average cleanliness rating...

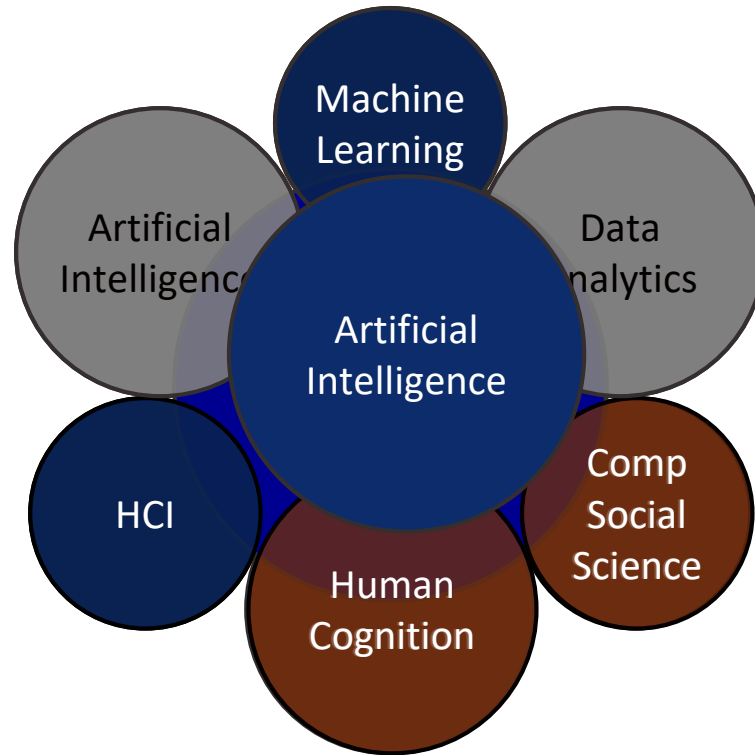


The new technologies are powerful but only part of the solution



The future of
computation is
integration,
interaction, and
communication

Integrated Intelligence



The Future of Intelligence