

The Future of Selling: How AI will Change Everything

Zbigniew Michalewicz
Chief Scientist



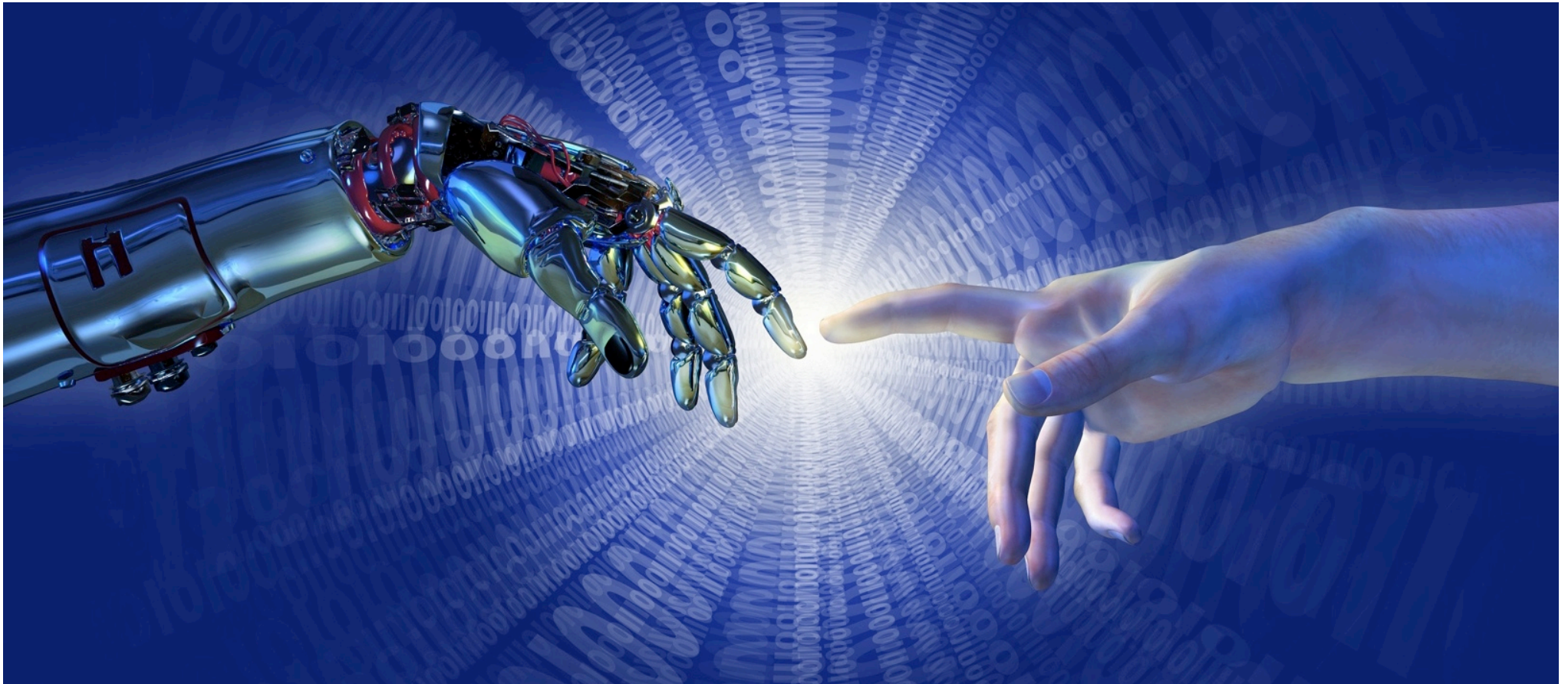
Outline of the talk

The time has come, the Walrus said,
To talk of many things:
Of shoes — and ships — and sealing-wax —
Of cabbages — and kings —
And why the sea is boiling hot —
And whether pigs have wings.

Lewis Carroll, *Through the Looking-Glass*

Some thoughts on AI

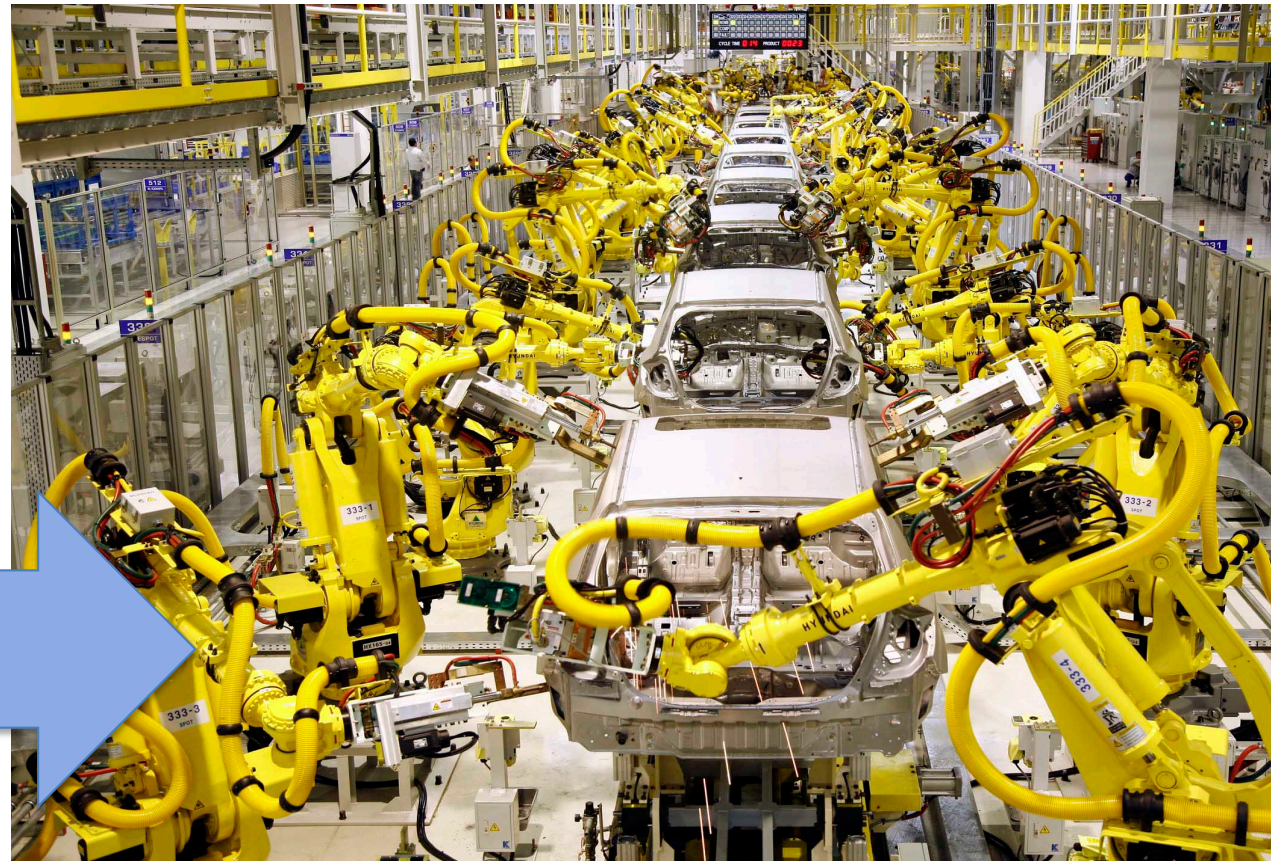
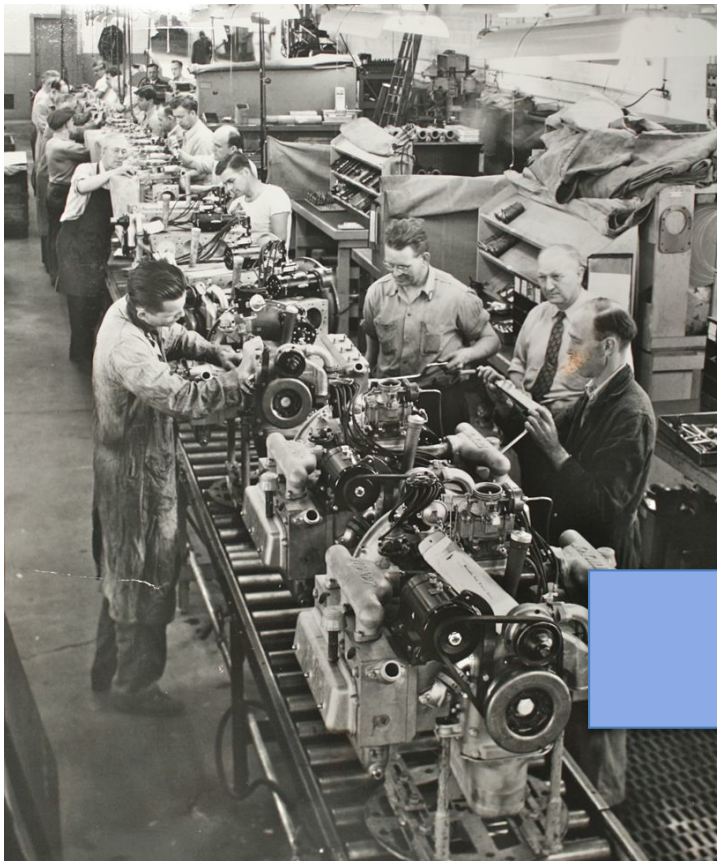
Artificial Intelligence... mimics nature



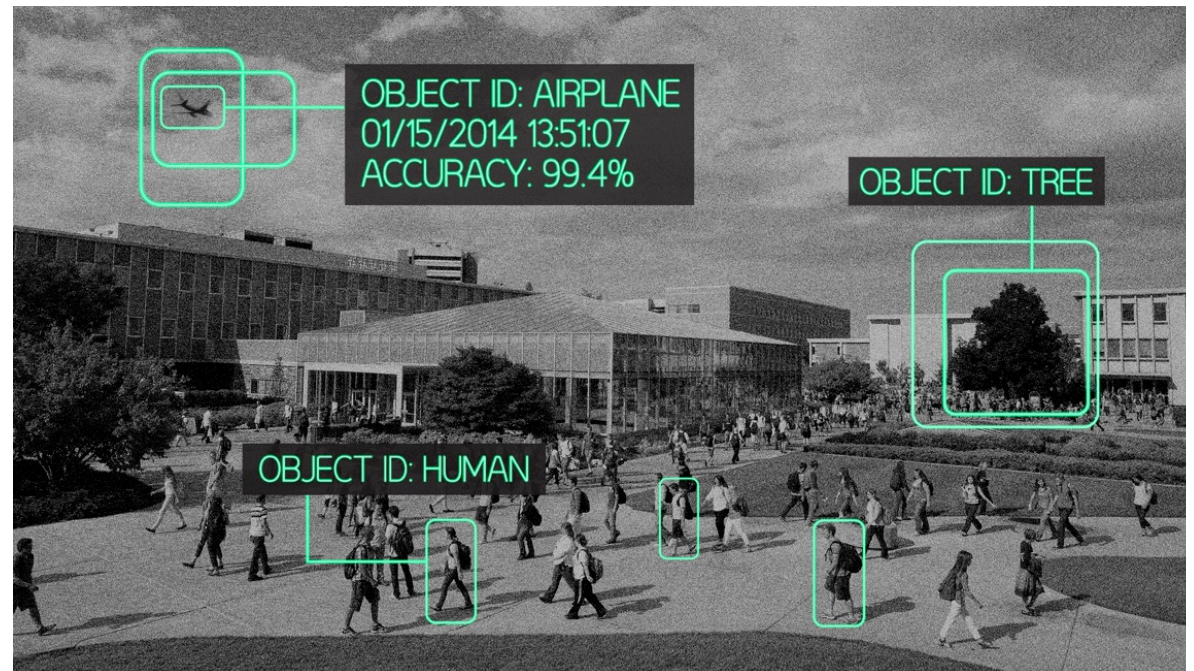
Artificial Intelligence – Robotics



Artificial Intelligence – Robotics



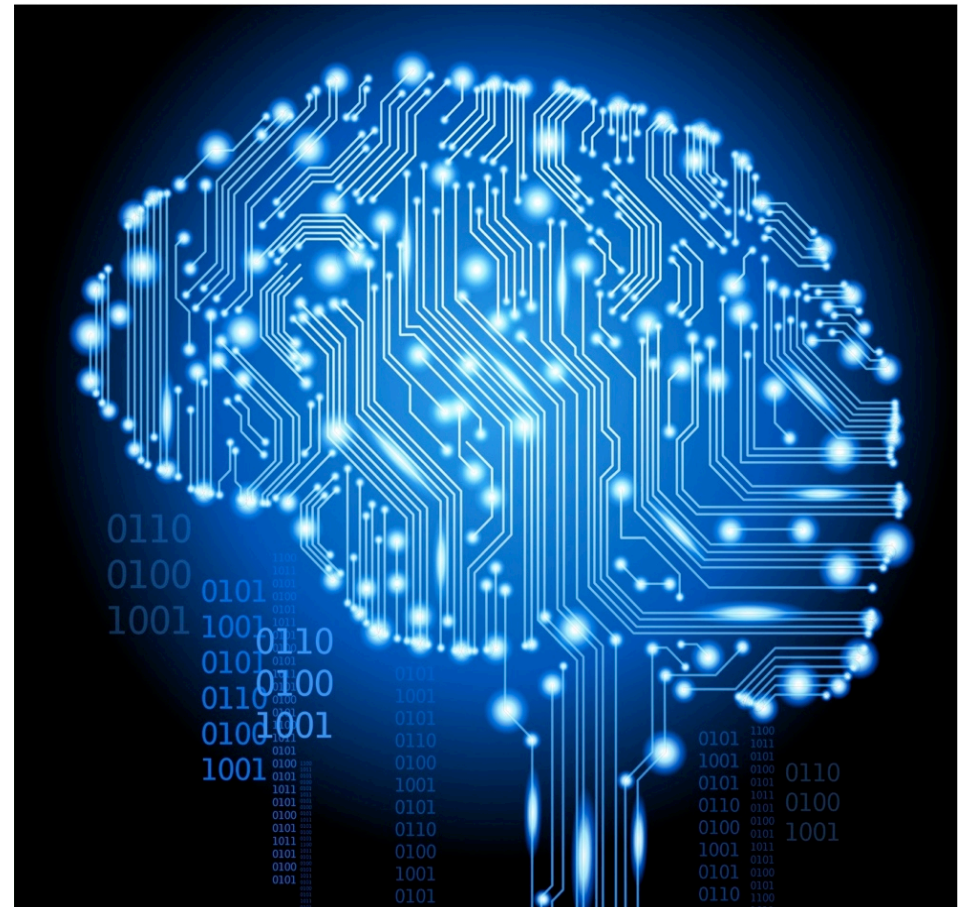
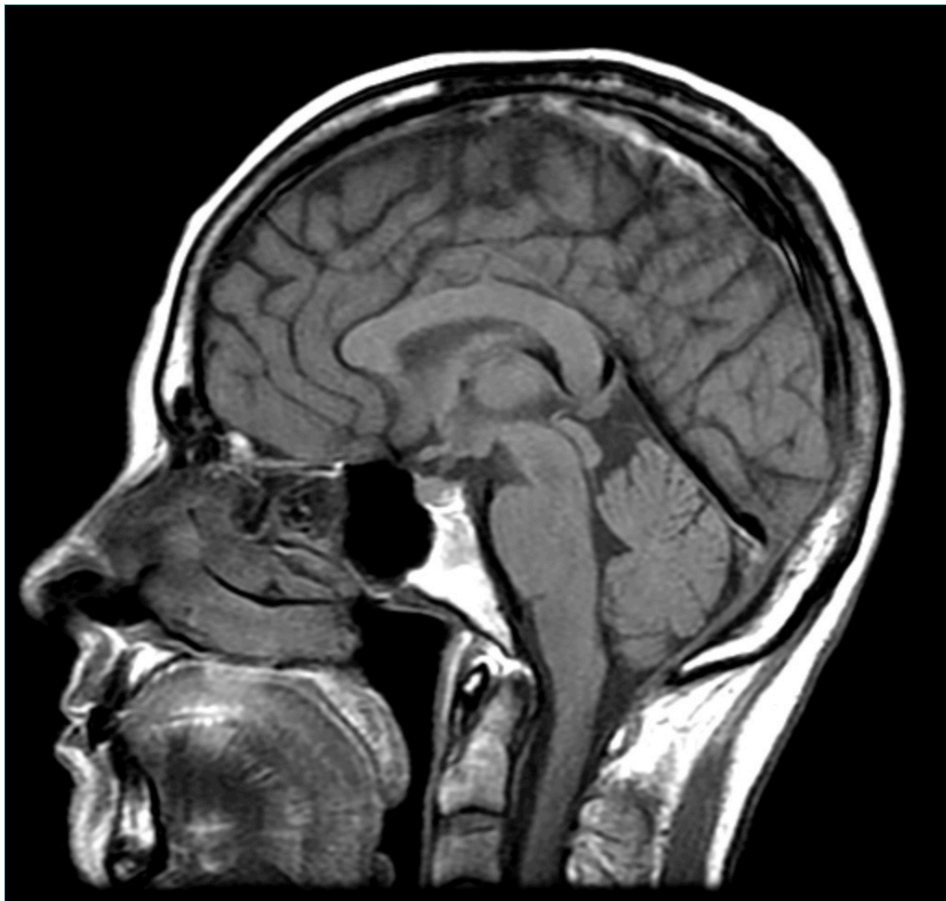
Artificial Intelligence – Vision



Artificial Intelligence – Natural Language Processing



Artificial Intelligence – Cognition

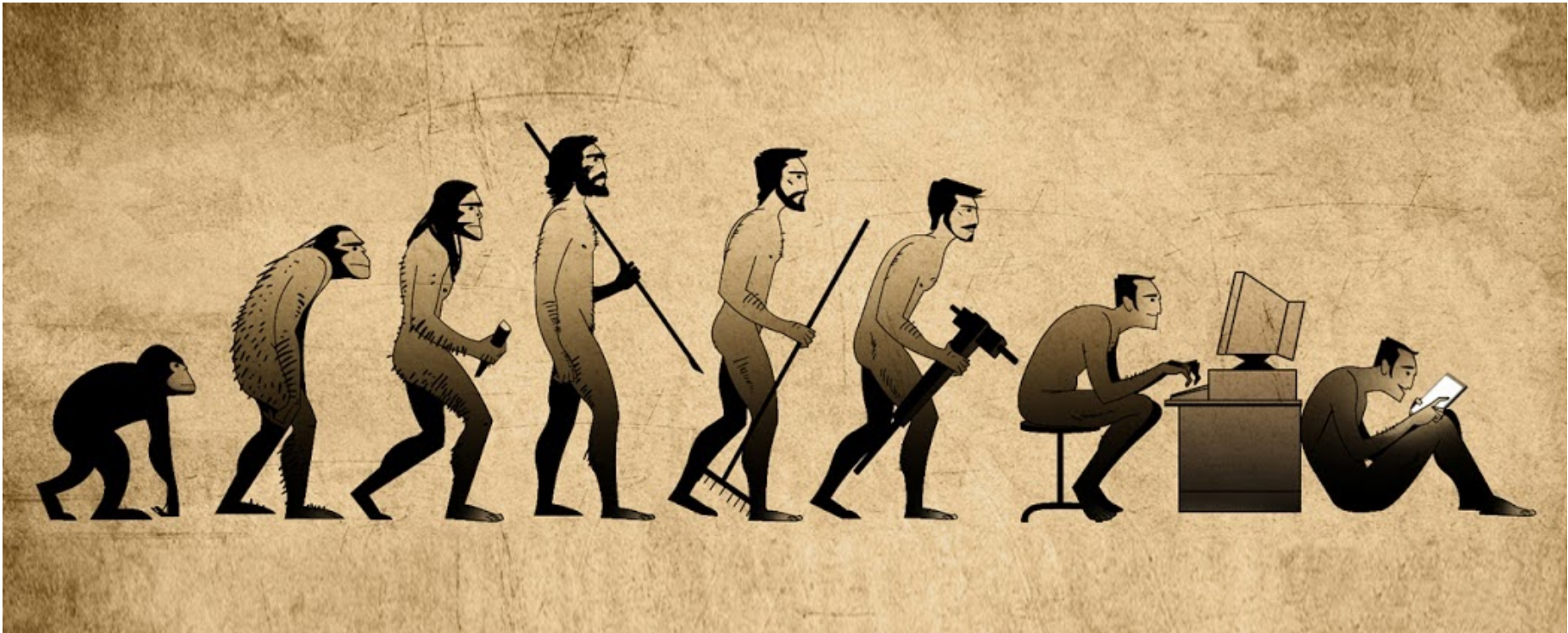


Artificial Intelligence Algorithms...

Unsurprisingly, many AI algorithms are inspired by nature and try to mimic natural processes...



Artificial Evolution Algorithms...



Intelligent answers are “evolved” rather than “computed”

40...	38...	38...	38...	38...	39...	39...	39...	39...	39...	40...	40...	40...	40...	40...	41...	41...	41...	41...	41...	42...	40...
210	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	210
610	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	610
10...	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	10...
14...	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	14...
18...	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	18...
22...	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	22...
26...	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	26...
30...	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	30...
34...	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	34...
38...	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	38...
42...	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	42...
46...	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	46...
50...	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	50...
54...	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	54...
58...	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	58...
62...	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	62...
66...	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	66...
70...	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	70...
74...	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	74...
78...	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	78...
40...	38...	38...	38...	39...	39...	39...	39...	39...	40...	40...	40...	40...	40...	41...	41...	41...	41...	41...	42...	40...	

Status

Generation: 0

Error: -

Control panel

Constraint

Constraint: Yes No

Dimension



Dimension: 20

Magic sum: 4010



A couple of things
about myself

Moving continents

9 June 1982



...from IPI PAN (Warsaw) to the Victoria University of Wellington (School of Computer Science)



© Can Stock Photo - csp19919809

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Moving continents (again)

30 June 1989



© Can Stock Photo - csp19919809

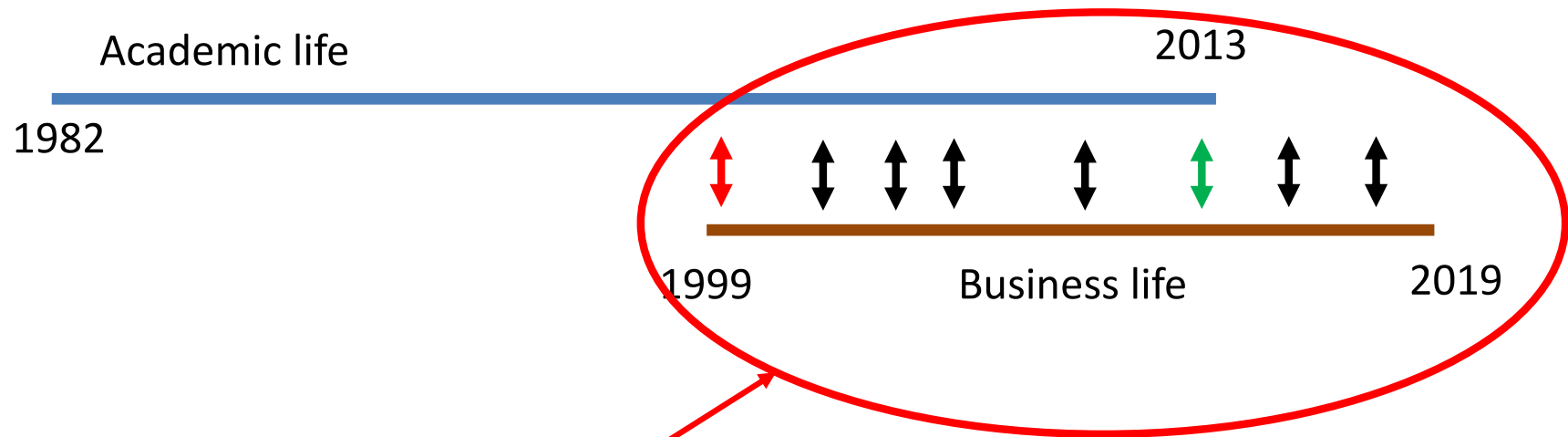


...from Victoria University of Wellington to
University of North Carolina at Charlotte
(for both: School of Computer Science)

Business life

- Academic life (June 1982 – January 2013)
 - ✓ Victoria University of Wellington, University of North Carolina - Charlotte, Aarhus University, University of Adelaide, Polish Academy of Sciences, Polish-Japanese Academy of Information Technology
 - ✓ 6 books, 17 edited books, many translations
 - ✓ almost 300 papers (almost 100 journal papers)
 - ✓ over 50,000 citations (Google Scholar), h-index 65
 - ✓ editorial boards, program committees, keynote talks
 - ✓ NSF, ARC, EU grants
- Business life (August 1999 – present)

Double life



The talk...

Business life – Overview

1999 – 2005



NETEZZA



2005 – 2012



2014 –



20 Years of Artificial Intelligence & Big Data Projects



Beiersdorf



RioTinto



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1999 – 2004

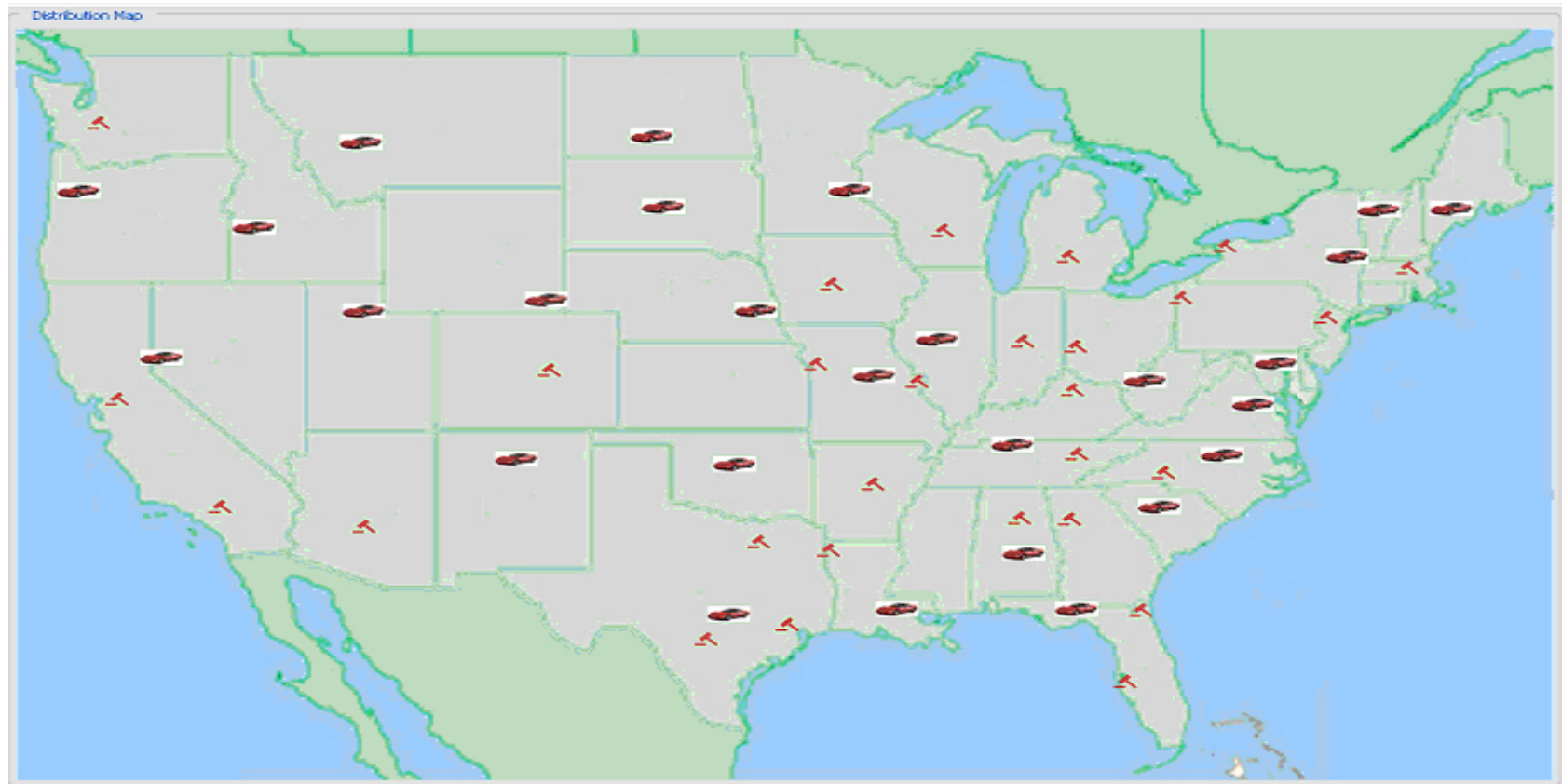
An interesting problem (2001)

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- General Motors sells 1.2 million off-lease cars each year on various auction sites.
- Each day, a remarketing team uses business intelligence tools and reports to decide where to ship 4,000 – 7,000 off lease cars.
- The problem is impacted by demand, depreciation, transportation schedules, cost of capital, risk, changes in market conditions, recent decisions, and the volume effect.

Car Distribution System

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Results

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Better: Net lift of \$213/car

Cheaper: 23 people down to 2

Faster: Seconds not man-days

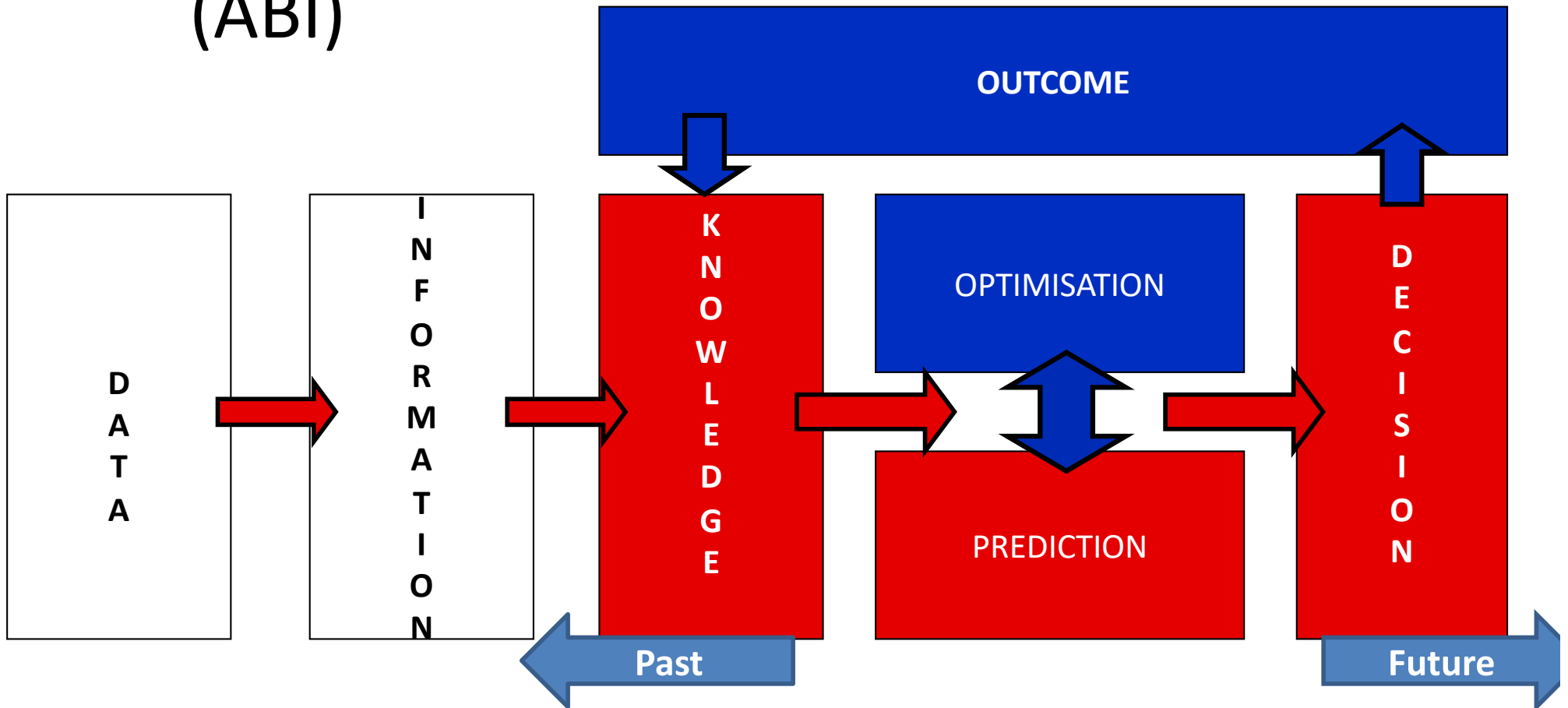
Data-driven decisions that are consistent

Predicted vs. actual comparisons

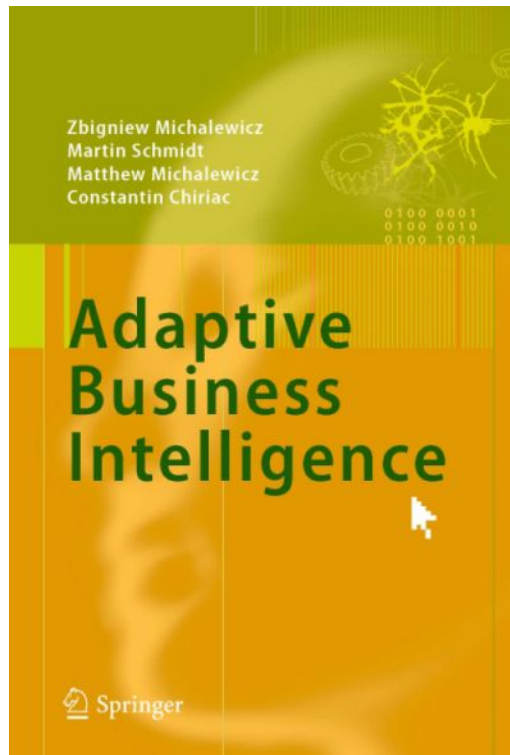
Closed loop for making improvement

Adaptive Business Intelligence (ABI)

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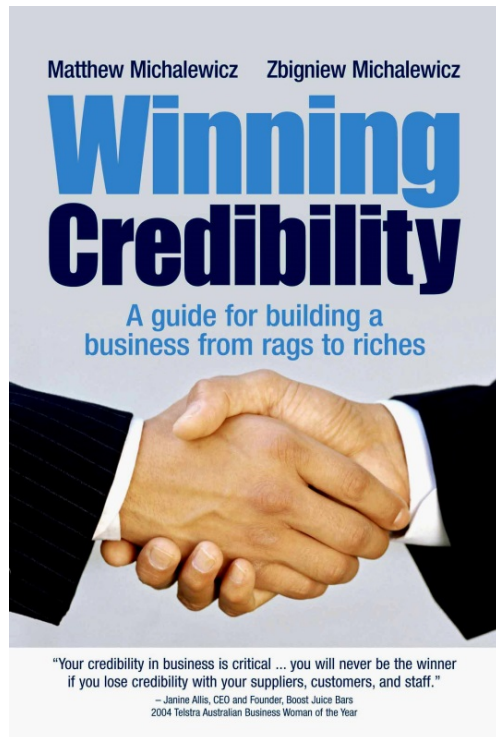


Adaptive Business Intelligence



...how to combine prediction, optimisation, and close the loop to create truly *intelligent* decision-support systems...

Running a company



...how to run a software company – based on true story... 😊

Some price to pay for leading “double life” ...

... the stress of running double life:
(1) being the Head of School of
Computer Science at the University
of North Carolina at Charlotte and
(2) the Chief Scientist at NuTech
Solutions at the same time was too
high...

22 November 2000



Moving continents (third time)...

18 November 2004



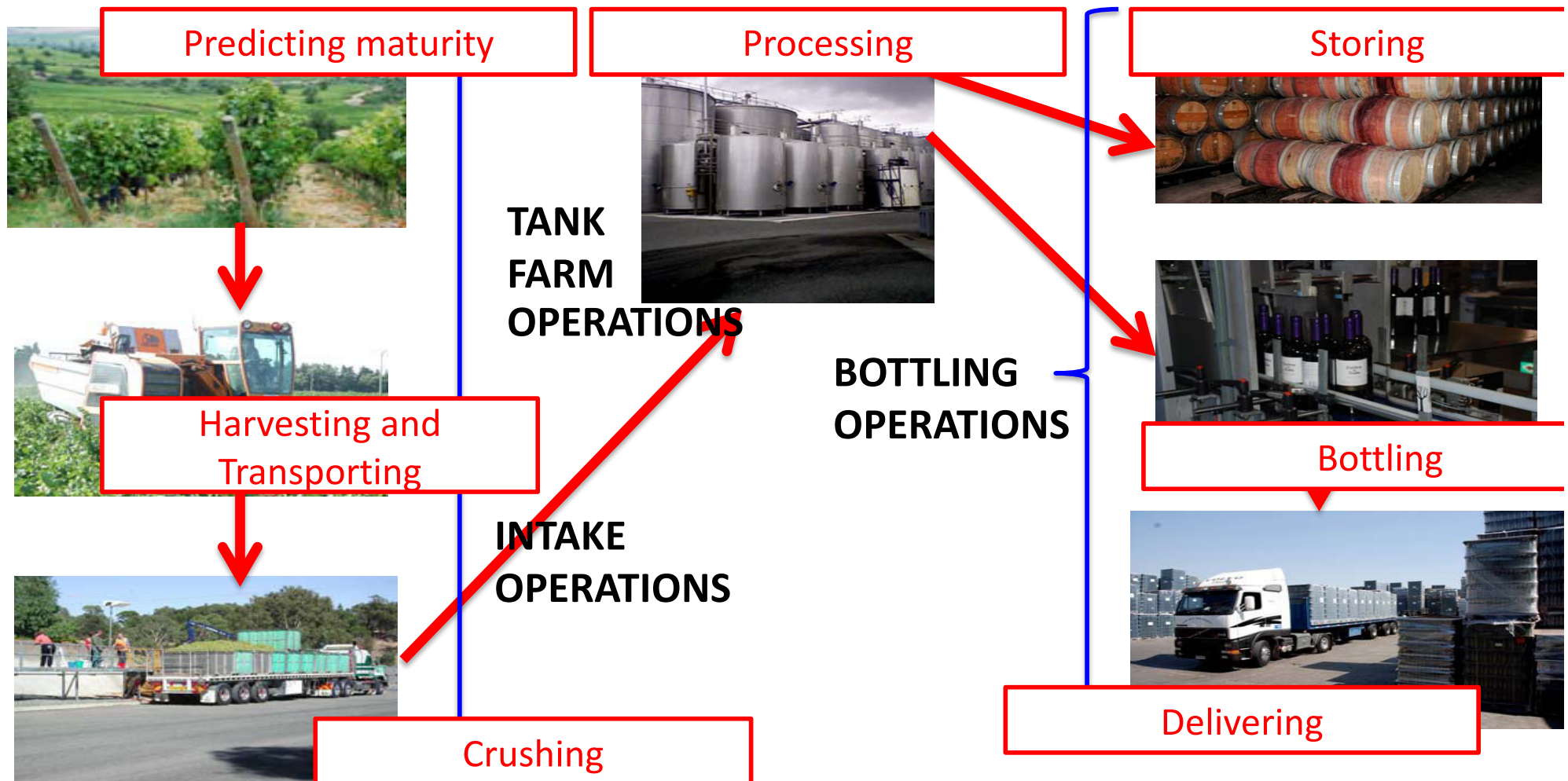
...from the University of North Carolina to the University of Adelaide (both places: Schools of Computer Science)



2005 – 2012

Wine Supply Chain – 2009

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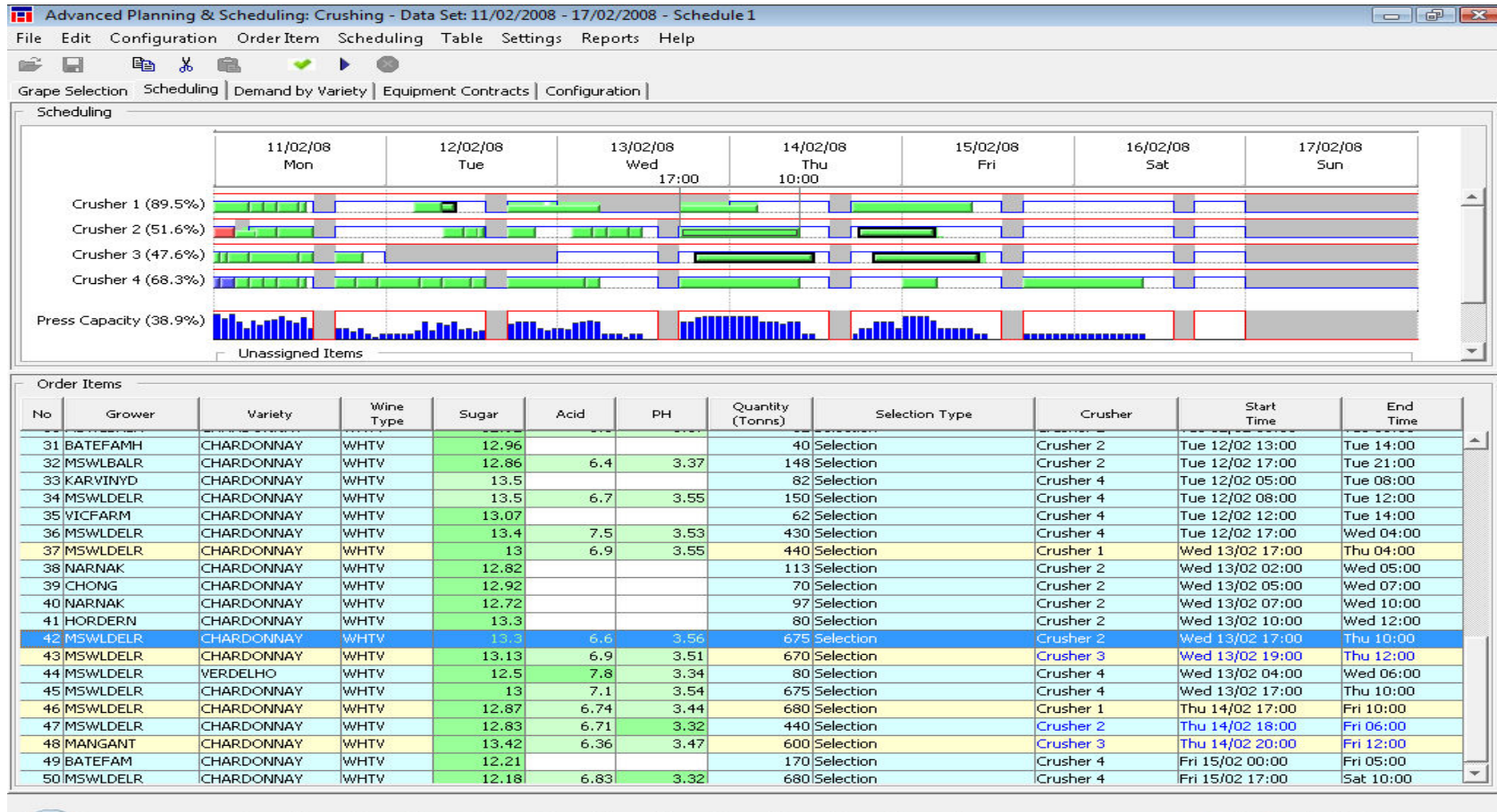
A Solution

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Intake Operations

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Tank Farm Operations

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Advanced Planning & Scheduling: Tank farm

File View Edit Optimization Table Tank Schedule Crush Op Note Settings Reports Help

Information loaded for the period from 16/03/2009 till 30/09/2010 Change

Tank Schedule Optimization Activities Crush Requests Push Requests Operational Notes Pull Requests Incoming Juice Production Plan Configuration

Map: Map Table Filter Date: 2/04/2009 Show Today 25% TKF5 TKF6 TKF4 TKF8

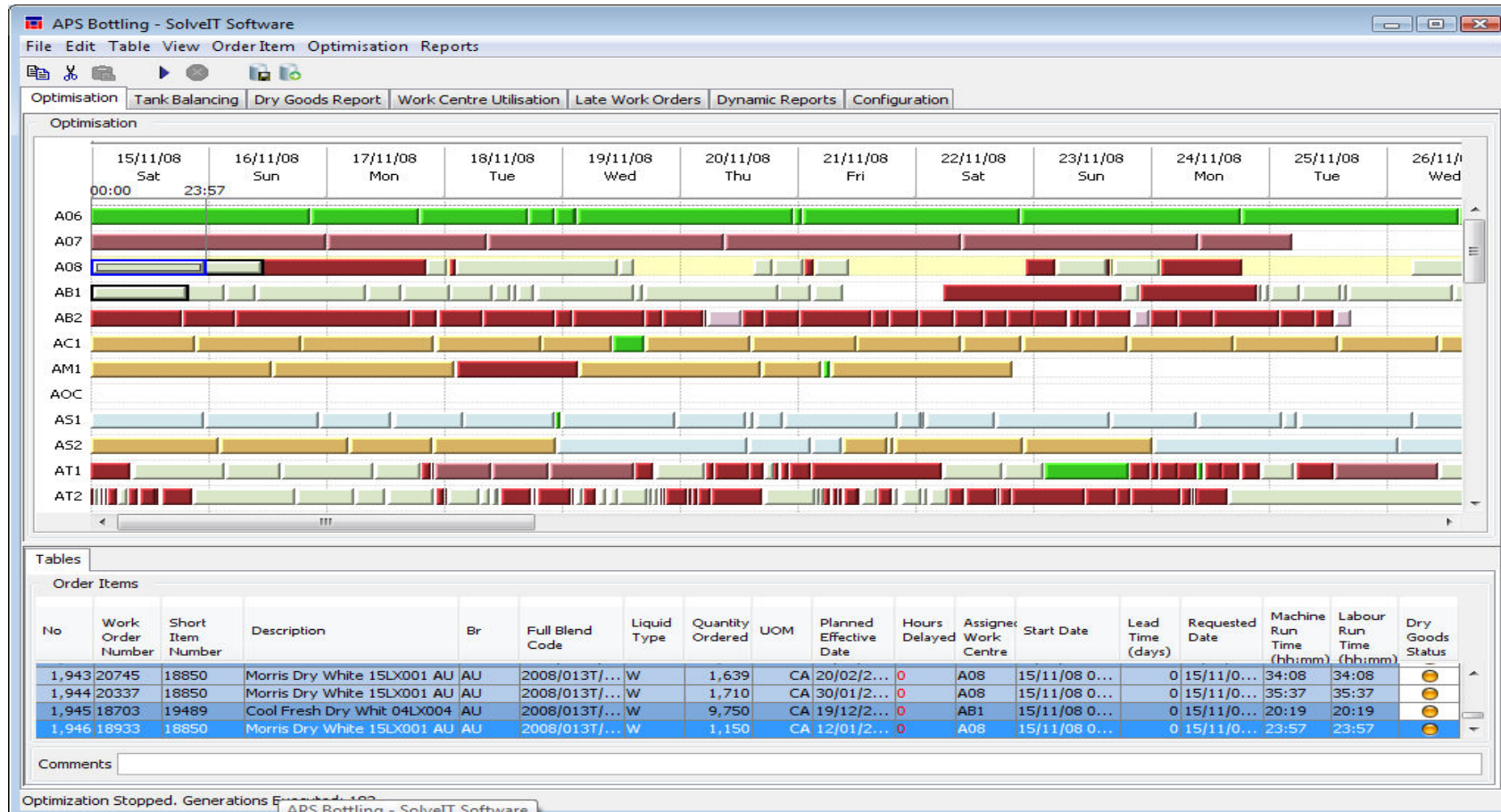
CL09 CL13 CL06 CL04 REDA SDRY CRSH CL15 CL05

Tank Content		Capacity	Area	Blend	Blend Description	Liters	Reservation	T Code	Year	Variety	Quality	Juice Type	Blended	State
Warni	Tank	1,417,849	TKF8			0	0	029T	2006				Yes	

Optimization Completed. Generations Executed: 107.398

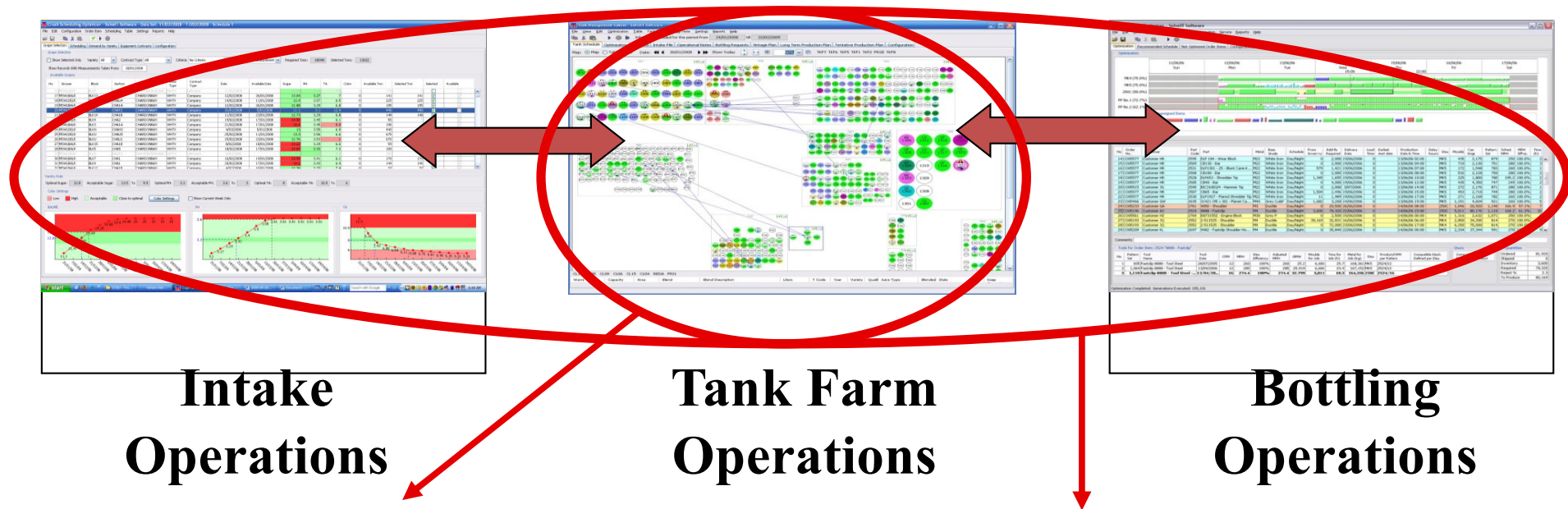
Bottling Operations

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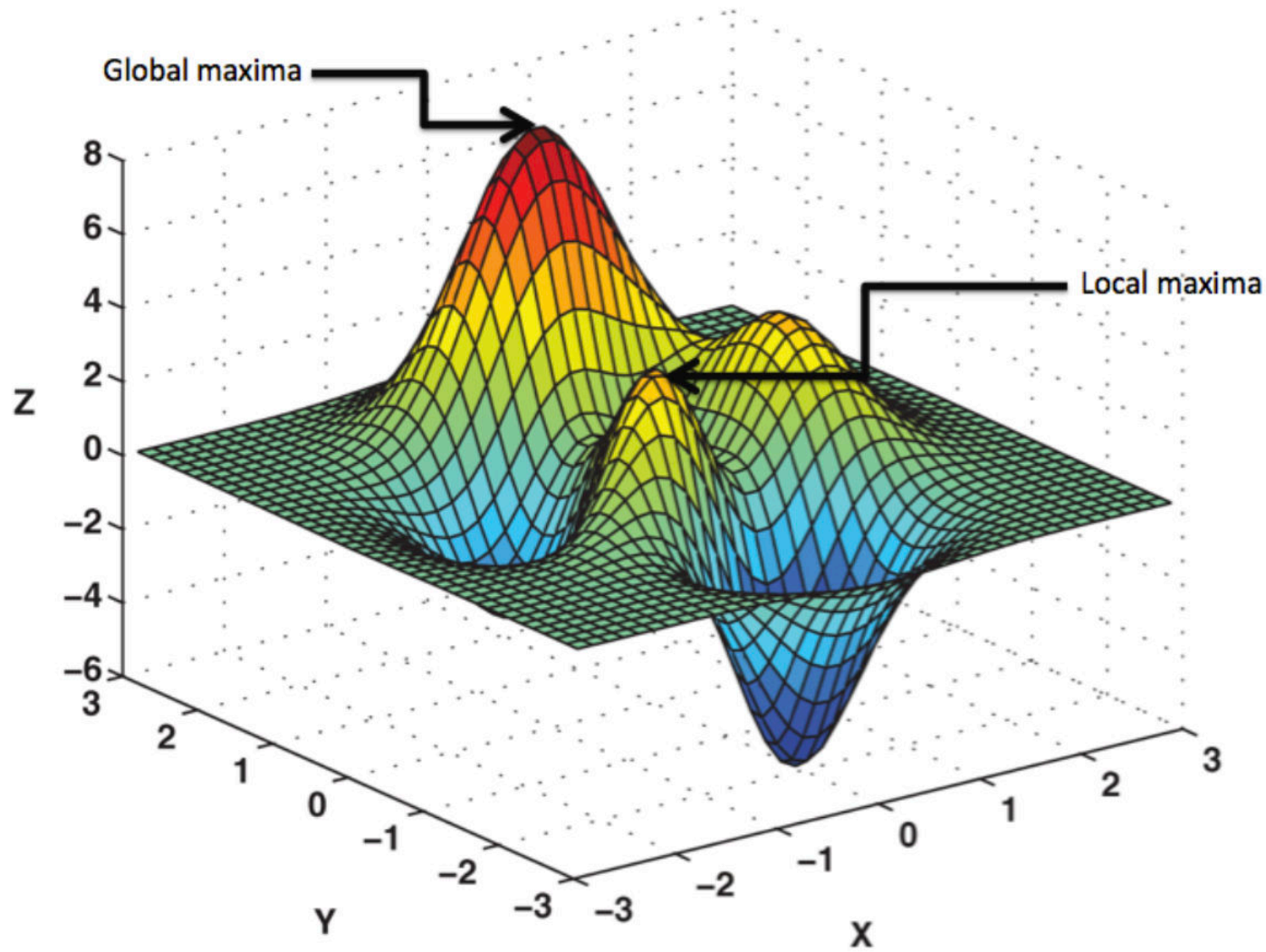
Global Optimisation

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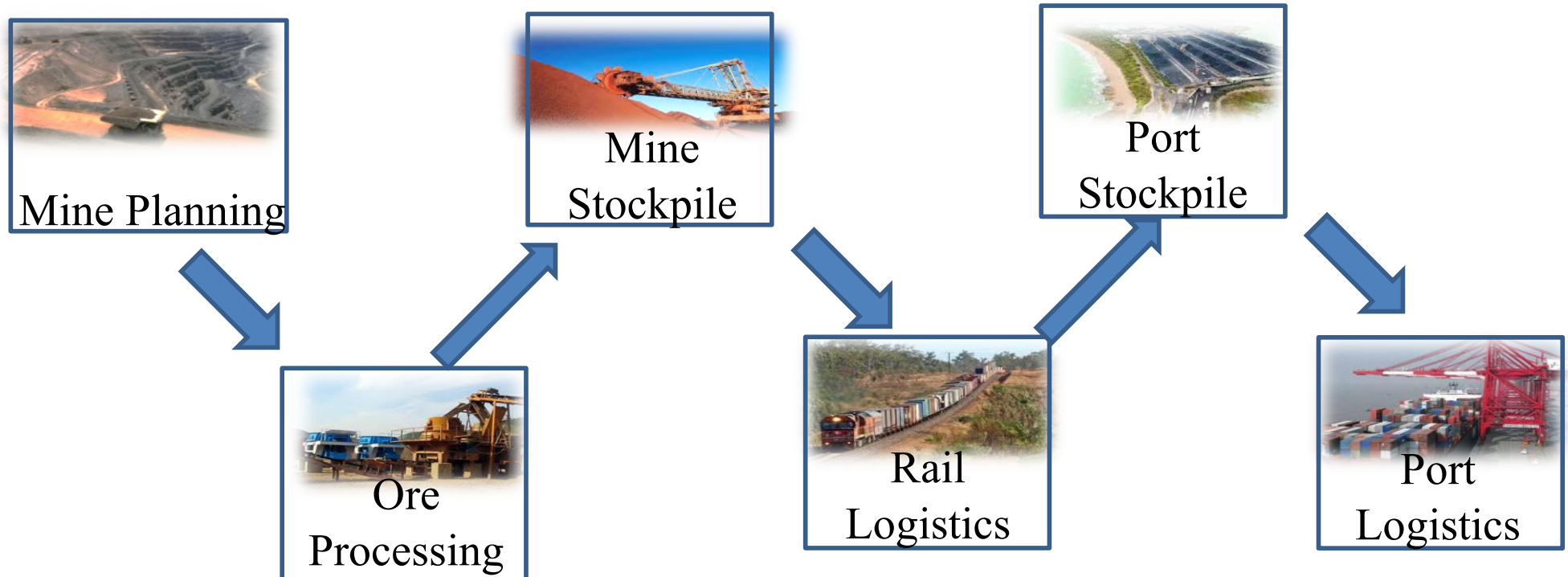
Local Optimisation:
What's best for a
business silo

Global Optimisation:
What's best for the
entire business



From Mine to Port Operations

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A thought from the past

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“Problems require holistic treatment. They cannot be treated effectively by decomposing them analytically into separate problems to which optimal solutions are sought.”

R. Ackoff, *The Future of OR is Past*, JORS, 1979.

Global Optimisation

- SolveIT Software was the first company to offer “global solutions” for supply chain problems (including what-ifs, optimisation)
- SolveIT Software won **every** mining tender: Billiton Mitsubishi Alliance, Xstrata, Fortescue, BHP Iron Ore, Hancock, PNC, QR, etc.

31 August 2012



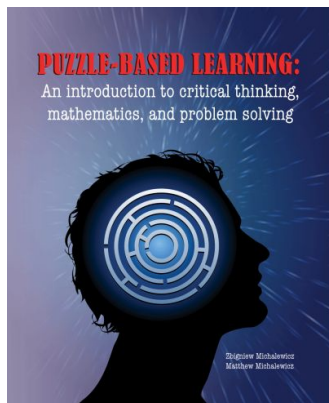
Late 2012 and early 2013

Real World Problems vs. Research...

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Puzzle-based Learning

Adaptive Business Intelligence



Global Optimisation

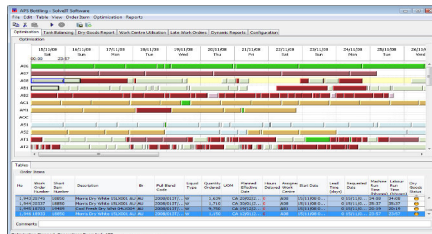
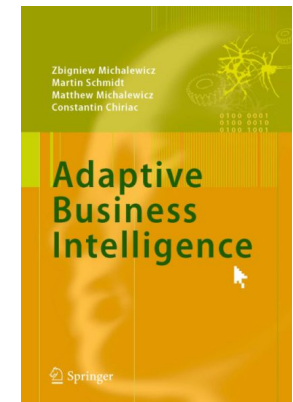
Partial Optimisation

Multi-component Problems

Constraint Handling Methods

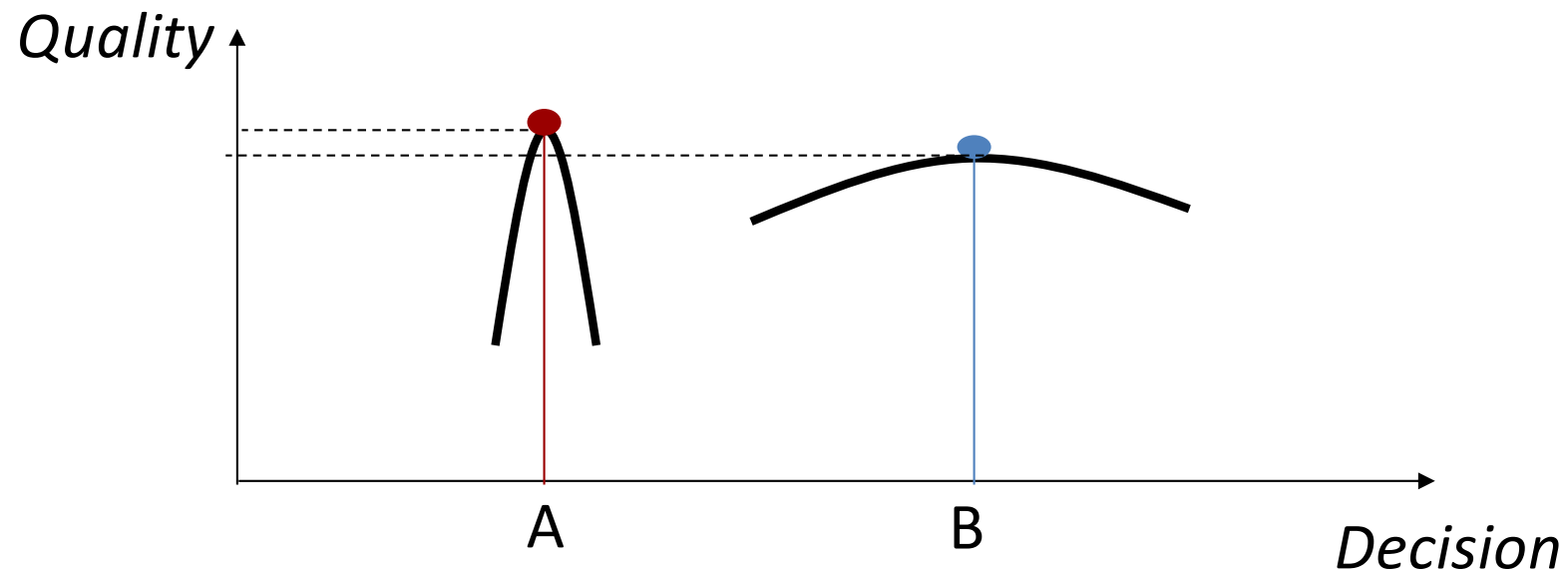
Explanatory Features

Time Horizons, Variability, and Risk



Variability and “Risk”

Without considering variability, some decisions will be “riskier” than others

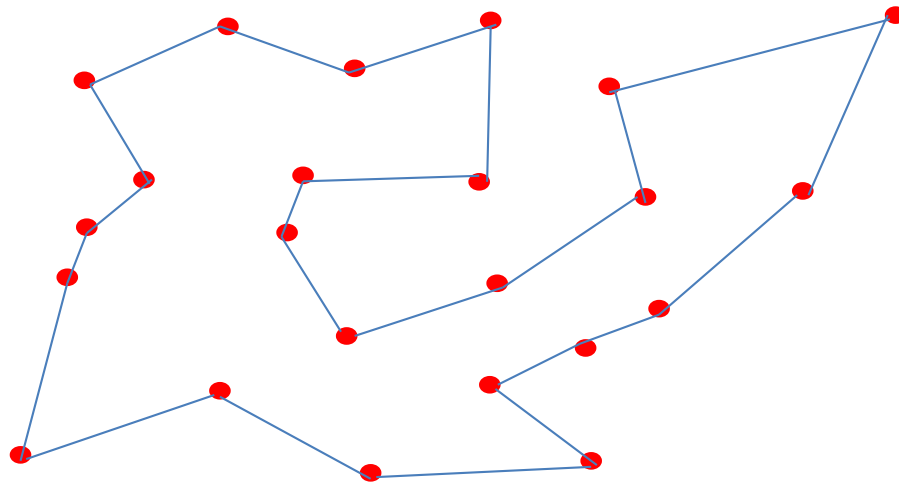


An article 😊

Bonyadi, M.R., Michalewicz, Z., and Barone, L.,
*Travelling Thief Problem: the first step in
transition from theoretical problems to realistic
problems*, Proceedings of the 2013 IEEE
Congress on Evolutionary Computation, Cancun,
Mexico, June 20 - 23, 2013.

Travelling salesman problem

Given a list of cities and all costs of moving between them, find a cycle that visits each city precisely once and minimizes the total cost...



- Thousands of research papers
- Many books
- Hundreds of algorithms
- Very active research area

Knapsack problem

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Given a list of items, each with a value V and a weight W , select a number of items to maximize the total value but not exceed the threshold weight (capacity).

Again:

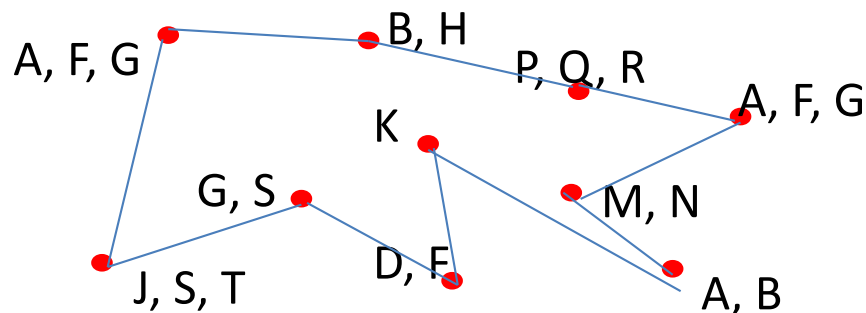
- Thousands of research papers
- Many books
- Hundreds of algorithms
- Very active research area...

Travelling thief problem

Given a list of cities and items available in these cities, find a cycle that visits each city precisely once, collect some items available in these cities, to

- (1) minimize the total cost of the travel, and
- (2) maximize the value.

Note, that **the cost of travel is a function of the current load...**



Supervising students

“Look at the last section [of some paper], where there were always some ‘open problems.’ Pick one, and work on it, until you are able to make a little progress. Then write a paper of your own about your progress, and don’t forget to include an ‘open problems’ section, where you put in everything you were unable to do.”

Jeff Ullman, 2009

Supervising students

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*“Unfortunately this approach, still widely practiced today, encourages mediocrity. [...] It almost guarantees that after a while, the work is driven by what **can** be solved, rather than what **needs** to be solved.”*

*“People write papers, and the papers get accepted because they are reviewed by the people who wrote the papers being improved incrementally, **but the influence beyond the world of paper-writing is minimal.**”*

Jeff Ullman, 2009

Some difficulties with publications...

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“I would never accept application-oriented paper in to my journal. Such papers are more appropriate for magazines that advertise cars.”

Editor-in-chief of a major journal, January 2013

Two essays

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1. Michalewicz, Z., *Quo Vadis, Evolutionary Computation? On a growing gap between theory and practice*, Springer LNCS State-of-the-Art Survey, J. Liu, C. Alippi, B. Bouchon-Meunier, G. Greenwood, H. Abbass (Editors), 2012.
2. Michalewicz, Z., *The Emperor is Naked: Evolutionary Algorithms for Real-World Applications*, ACM Ubiquity, November 2012, pp. 1 - 13.

Famous quote...

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“Do you want to spend the rest of your life selling sugared water or do you want a chance to change the world?”

Steve Jobs, 1984

January 2013

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January 2013:

- ... resigned from my position at the University of Adelaide
- ... resigned from all editorial boards
- ... resigned from all program committees
- ...and thought about changing my life...😊

“What should I do with my life that started so nicely?”



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30 July 2014



Key question for any company

How to sell more, at a higher margin?

The Problem...

Data

How can we capture margin? revenue?

What products should we offer?

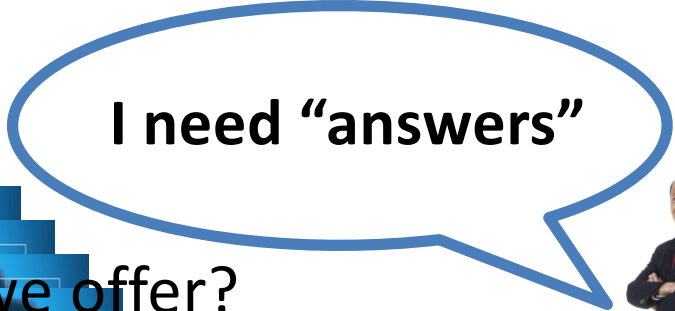
What customers should we target?

How many sales reps do we need?

How can we get a better return on promotional spend?

Do we have the right product mix?

What is our "cost to serve"?



Requires people,
tools, and time

More "answers" = more people



Generating "Answers"



Data



D

DATA

Here's the answer



I need "answers"



DECISION



Decisions



What is “Larry”?

A collection of smart algorithms for:

Data capture, checking, cleaning

Data analysis

Prediction

Optimisation

Learning

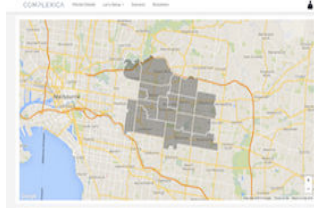
Etc.

...configured to answer complex questions

Applications



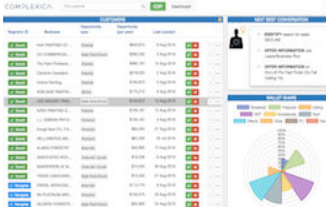
What-if Simulator



Optimise sales structure and answer “what-if” questions



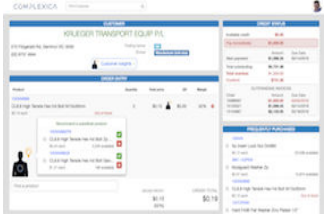
COP



Optimise sales activities and “next best conversation”

Computational Engine
Larry, the Digital Analyst®

OMS



Optimise transactions for revenue and margin

Sales: Yesterday vs. Tomorrow

A sales rep is about to visit a small Italian restaurant in the city area...

Sales: Yesterday vs. Tomorrow

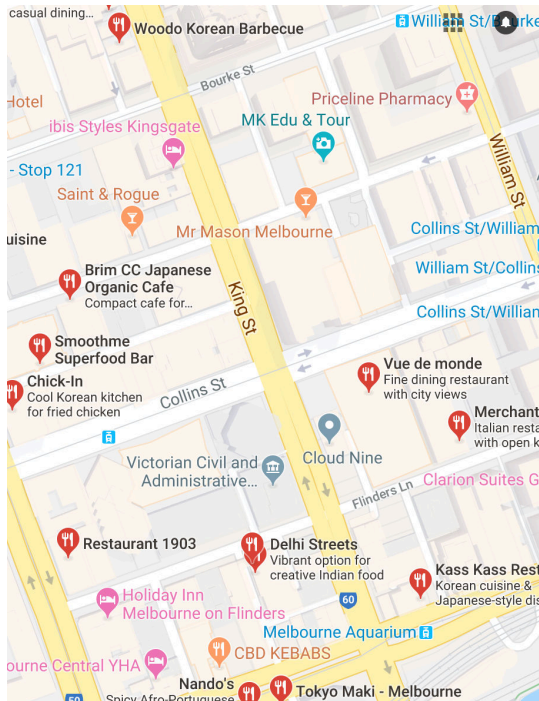
“Here are my catalogues...”

The collage features several wine-related elements:

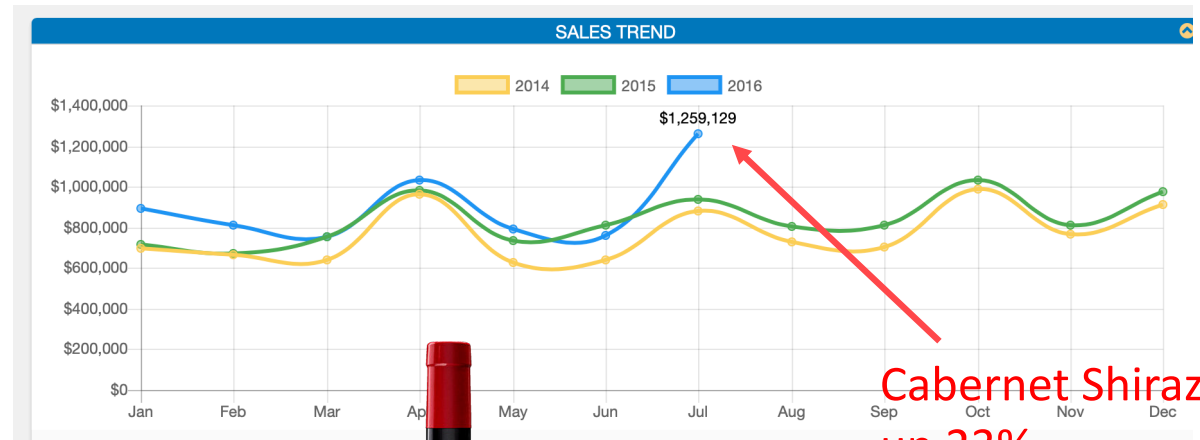
- Top Right:** A hand holding an open magazine titled "ADNAMS SOUTHWOLD SELECTION". The magazine displays various wine bottles with numbered callouts (1-9) and descriptive text.
- Middle Left:** Three bottles of wine standing side-by-side. The first bottle has a blue circular badge with the number "93" and "ROBERT PARKER". The third bottle has a blue circular badge with the number "92" and "ROBERT PARKER".
- Bottom Left:** An advertisement for "SAXENBURG ASSO 1693". It features a bottle of wine and a landscape with geese. Text includes "Between two mighty oceans, on the southern tip of Africa, lies the historic Saxenburg Wine Farm." and a "FIND OUT MORE" button.
- Bottom Center:** A grid of four wine products with their names, vintages, and prices:

BEAUMONT	GRAHAM BECK	STEENBERG	DALLA CIA
Hope Marguerite 2013	Brut Blanc de Blancs 2010	Magna Carta 2012	Giorgio 2011
★★★★ (413)	★★★★ (1208)	★★★★ (196)	★★★★ (728)
R 165.00	R 950.00	R 525.00	R 950.00
- Bottom Right:** An advertisement for "6 SINGLE VARIETAL Selection CHARDONNAY". It shows six bottles of wine and includes the text "ONLY R 1,189 - SHOP NOW".

Sales: Yesterday vs. Tomorrow



...you are one of 14 restaurants in this area...



Cabernet Shiraz up 23%



Special offer (just for you):
24 bottles of Penfold's Bin 389 for just \$720...

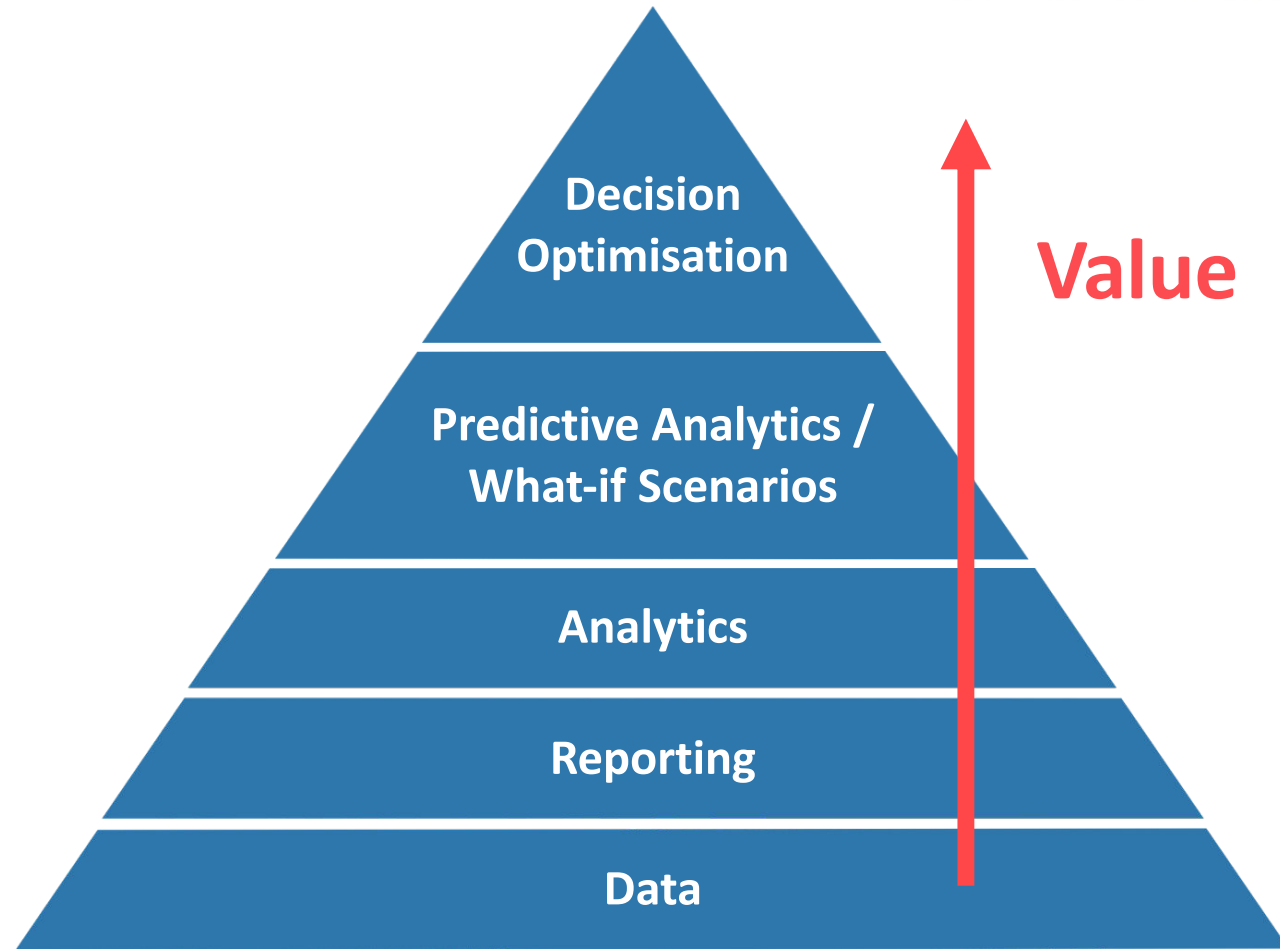
Conclusions

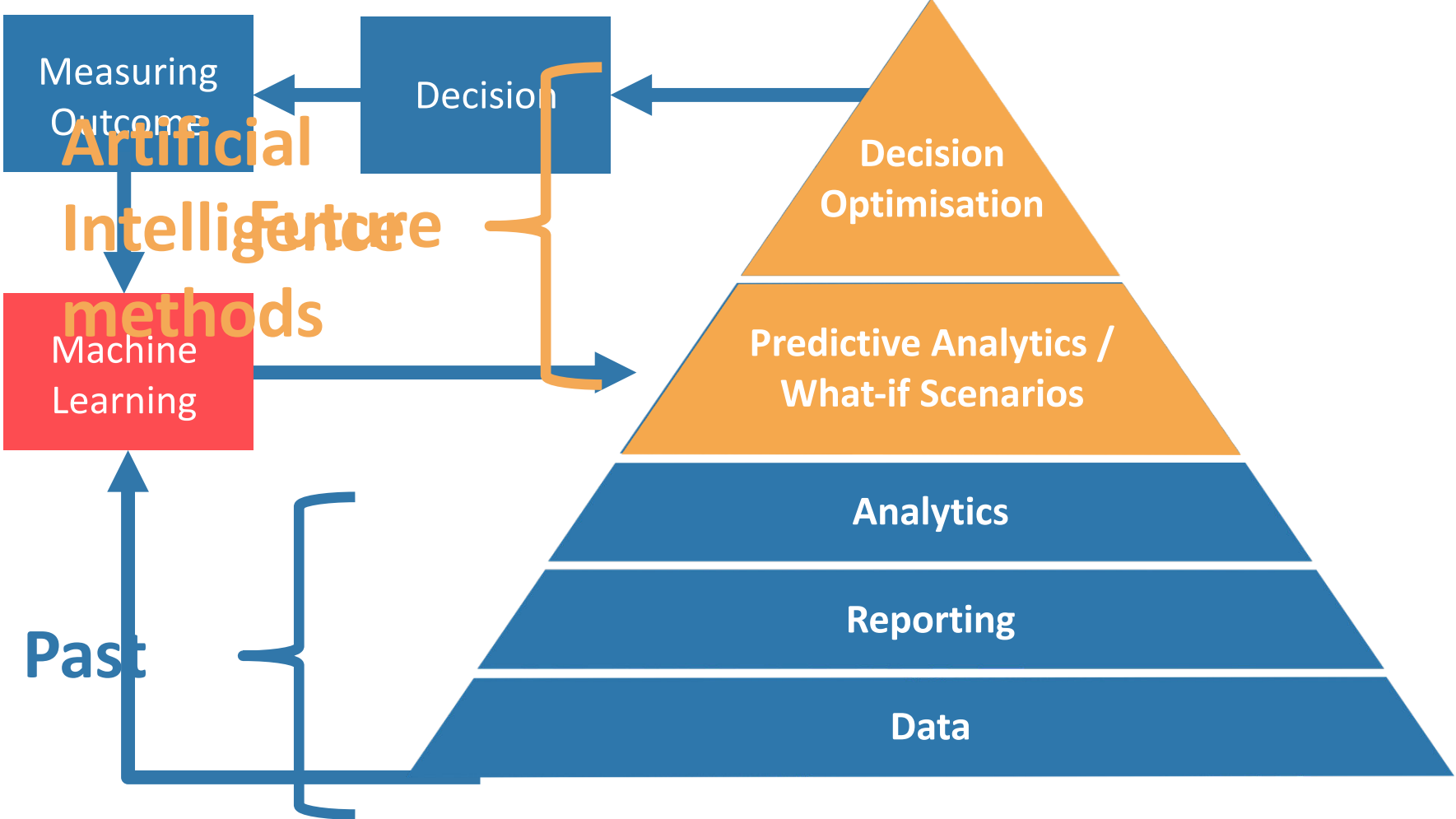
Motto

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Knowledge that does not change behaviour is useless.

Yuval Noah Harari, *Homo Deus*







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Thank you...

