

Pulse2012

On February 14, 2011, IBM Watson Made History

Word spread virally of the victory with Twitter reaching **11.7M**, **30,121** blog mentions, and **15,025** forum posts



Brief History of IBM Watson



The World Is Getting Smarter



Instrumented

Over 10 billion CPUs were produced in 2008, up 1000% in 8 years.



Interconnected

2 billion people will be on the Web by 2011... with a trillion connected objects.



Intelligent

Stockholm leverages GPS data to predict traffic – reducing congestions and emissions.

Businesses Are “Dying of Thirst in an Ocean of Data”

90%

of the world's data
was created in the last
two years

80%

of the world's data
today is unstructured

20%

amount of available
data traditional
systems leverages



Businesses Are “Dying of Thirst in an Ocean of Data”

1 in 2

Business leaders
don't have access
to data they need

83%

of CIOs cited BI and
analytics as part of
their visionary plan

5.4x

More likely that top
performers use
business analytics

So Why Is it So **Hard For Computers** to Understand Humans

Where was Einstein born?

Structured Data

Physicist	Birth Place
A. Einstein	Ulm
N. Bohr	Copenhagen
M. Curie	Warsaw

Welch ran this?

Person	Organization
L. Gerstner	IBM
J. Welch	GE
W. Gates	Microsoft

Unstructured Data

“One day, from among his city views of Ulm, Otto chose a watercolor to send to Albert Einstein as a remembrance of Einstein’s birthplace.”

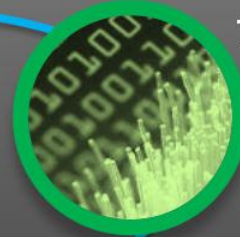
“If leadership is an art then surely Jack Welch has proved himself a master painter during his tenure at GE.”

IBM Watson Brings Together a Set of Transformational Technologies to Drive **Optimized Outcomes**

1 Understands **natural language and human speech**



2 Generates and evaluates hypothesis for better outcomes



3 Adapts and learns from user selections and responses



... built on a massively parallel probabilistic evidence-based architecture optimized for POWER7

Healthcare Industry Is Beset with Some of the Most **Complex Information Challenges** We Collectively Face



Medical information is doubling every 5 years, much of which is unstructured



81% of physicians report spending 5 hours or less per month reading medical journals

“Medicine has become too complex. Only about 20 percent of the knowledge clinicians use today is evidence-based.”

Steven Shapiro

Chief Medical and Scientific Officer, UPMC



1 in 5

diagnoses are estimated to be inaccurate or incomplete



1.5 million

errors in the way medications are prescribed, delivered and taken in the U.S. every year



44,000 – 98,000

of Americans who die each year from preventable medical errors in hospitals alone

Cancer Is an Insidious Disease and
the **Second Highest Cause of Death**



Working Together to Beat Cancer

Cancer Is an Insidious Disease and the **Second Highest Cause of Death**

1 in 4

individuals will die from cancer



3X

rate cancer cost climbs vs. std. health costs or 15-18% / yr.



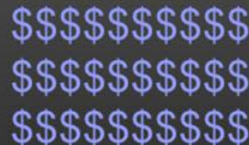
20%

of cancer cases receive the wrong diagnosis initially with some as high as 44%



263.8B

overall costs of cancer in the US in 2010



Cancer (US ONLY)	2011 New Cases (est.)	2011 Deaths	%
Respiratory	239320	161250	28%
Digestive	277570	139250	24%
Genital	338620	63980	11%
Breast	232620	39970	7%
Urinary	132900	28970	5%
Lymphoma	75190	20620	4%
Leukemia	44600	21780	4%
Oral	39400	7900	1%
Other	216450	88230	16%
TOTAL	1,596,670	571,950	100%



Working Together to Beat Cancer

Source: American Cancer Society, National Health Institute

Putting the Pieces Together at **Point of Impact**
Can Be Life Changing

Putting the Pieces Together at **Point of Impact** Can Be Life Changing

Symptoms

A 58-year-old woman complains of **dizziness**, **anorexia**, **dry mouth**, **increased thirst**, and **frequent urination**. She had also had a **fever**. She reported no pain in her abdomen, back, and no cough, or diarrhea.



Putting the Pieces Together at **Point of Impact** Can Be Life Changing

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Symptoms

difficulty swallowing
fever
dry mouth
thirst
anorexia
frequent urination
dizziness



- Extract **Symptoms** from record

Putting the Pieces Together at **Point of Impact** Can Be Life Changing

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Symptoms

difficulty swallowing
fever
dry mouth
thirst
anorexia
frequent urination
dizziness



- Extract **Symptoms** from record
- Use paraphrasings mined from text to handle alternate phrasings and variants

Putting the Pieces Together at **Point of Impact** Can Be Life Changing

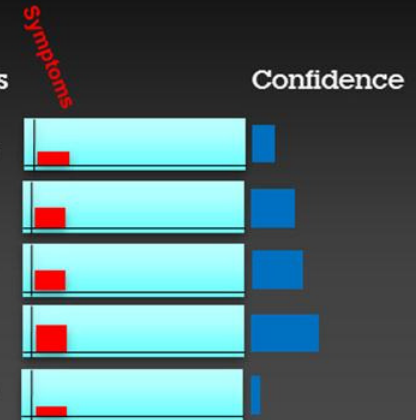
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Symptoms
difficulty swallowing
fever
dry mouth
thirst
anorexia
frequent urination
dizziness

Diagnosis Models



Most Confident Diagnosis: **Influenza**

Putting the Pieces Together at **Point of Impact** Can Be Life Changing

Symptoms

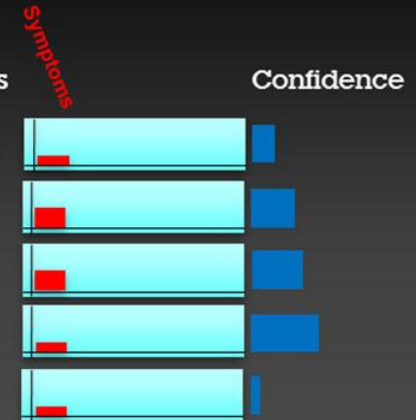
A 58-year-old woman presented to her primary care physician after several days of **dizziness**, **anorexia**, **dry mouth**, **increased thirst**, and **frequent urination**. She had also had a **fever** and reported that **food would "get stuck"** when she was **swallowing**. She reported no **pain** in her abdomen, back, or flank and no **cough**, **shortness of breath**, **diarrhea**, or **dysuria**.



Symptoms

- difficulty swallowing
- fever
- dry mouth
- thirst
- anorexia
- frequent urination
- dizziness
- no abdominal pain
- no back pain
- no cough
- no diarrhea

Diagnosis Models



Most Confident Diagnosis: Influenza

- Identify negative **Symptoms**

Putting the Pieces Together at **Point of Impact** Can Be Life Changing

Symptoms

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Symptoms

difficulty swallowing
fever
dry mouth
thirst
anorexia
frequent urination
dizziness
no abdominal pain
no back pain
no cough
no diarrhea

Diagnosis Models

Symptoms

Confidence

Renal failure



UTI



Diabetes



Influenza



Hypokalemia



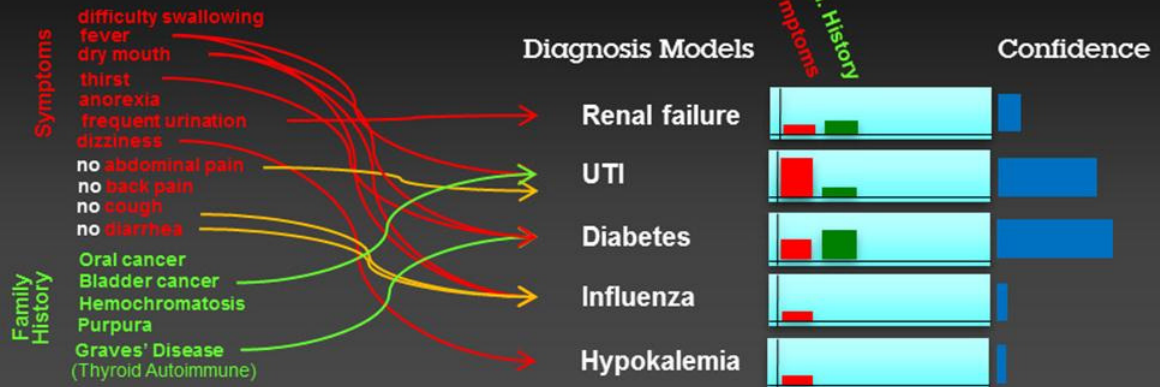
Most Confident Diagnosis: **UTI**

- Identify negative **Symptoms**
- Reason with mined relations to explain away symptoms (thirst is consistent w/ UTI)

Putting the Pieces Together at **Point of Impact** Can Be Life Changing

Family History

Her family history included oral and bladder cancer in her mother, Graves' disease in two sisters, hemochromatosis in one sister, and idiopathic thrombocytopenic purpura in one sister



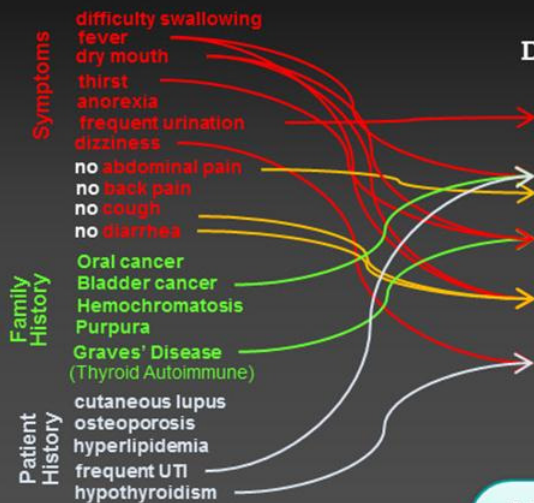
Most Confident Diagnosis: **Diabetes**

- Extract **Family History**
- Use Medical Taxonomies to generalize medical conditions to the granularity used by the models

Putting the Pieces Together at **Point of Impact** Can Be Life Changing

Patient History

Her history was notable for cutaneous lupus, hyperlipidemia, osteoporosis, frequent urinary tract infections, a left oophorectomy for a benign cyst, and primary hypothyroidism, diagnosed a year earlier



Diagnosis Models



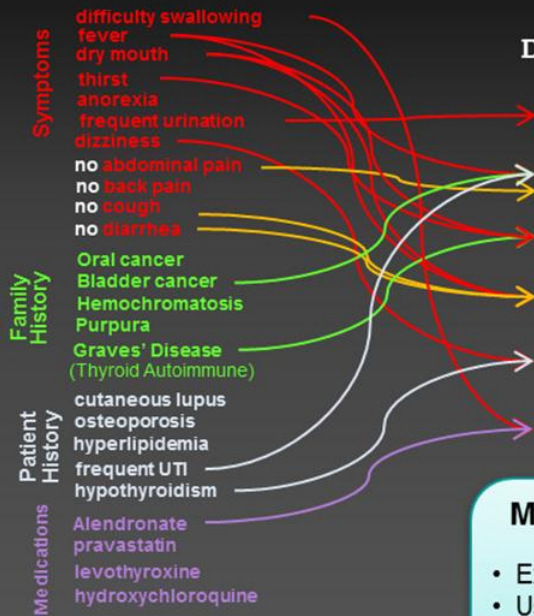
Most Confident Diagnosis: UTI

- Extract Patient History

Putting the Pieces Together at **Point of Impact** Can Be Life Changing

Medications

Her medications were levothyroxine, hydroxychloroquine, pravastatin, and alendronate.



Diagnosis Models



Most Confident Diagnosis: **UTI**

- Extract Medications
- Use database of drug side-effects
- Together, multiple diagnoses may best explain symptoms

Putting the Pieces Together at **Point of Impact** Can Be Life Changing

Findings

A urine dipstick was positive for leukocyte esterase and nitrites. The patient given a prescription for ciprofloxacin for a urinary tract infection. 3 days later, patient reported weakness and dizziness. Her supine blood pressure was 120/80 mm Hg, and pulse was 88.



Symptoms
 difficulty swallowing
 fever
 dry mouth
 thirst
 anorexia
 frequent urination
 dizziness
 no abdominal pain
 no back pain
 no cough
 no diarrhea

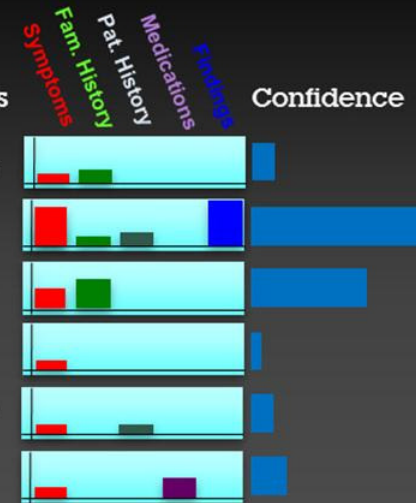
Family History
 Oral cancer
 Bladder cancer
 Hemochromatosis
 Purpura
 Graves' Disease (Thyroid Autoimmune)

Patient History
 cutaneous lupus
 osteoporosis
 hyperlipidemia
 frequent UTI
 hypothyroidism

Medications
 Alendronate
 pravastatin
 levothyroxine
 hydroxychloroquine

Findings
 urine dipstick:
 leukocyte esterase
 supine 120/80 mm HG
 heart rate: 88 bpm
 urine culture: E. Coli

Diagnosis Models



Most Confident Diagnosis: **UTI**

- Extract **Medications**
- Use database of drug side-effects
- Together, multiple diagnoses may best explain symptoms
- Extract **Findings**: Confirms that UTI was present

IBM Watson Is a New Class of Industry-specific Analytical Solutions

WATSON

Solutions



Watson for Healthcare

Advisor Solutions

Utilization
Oncology
Cardiac
Diabetes

NOW



Watson for Financial Svcs.

Advisor Solutions

Equities
529 Plans
Retirement
Institution

NOW

Watson for Contact Center

Advisor Solutions

Call Center
Help Desk
Knowledge
Technical

FUTURE

Watson for Industry



FUTURE

Capabilities



NLP & Content Analytics



Machine Learning



Big Data



Reporting & Analysis



Data Warehouses



Workload Optimized Systems

Platform



Source



Model



Train



Learn

Cloud Model Provides Critical Capabilities for IBM Watson

Flexible Consumption

Support alternative delivery and pricing models



Flexible Consumption

Dynamic Capacity

Automate and control service provisioning



Dynamic Capacity

Hybrid Delivery

Extend & integrate on-premise solution with cloud offering



Hybrid Delivery

Time to Value

Enable incremental automation and business agility



Time to Value

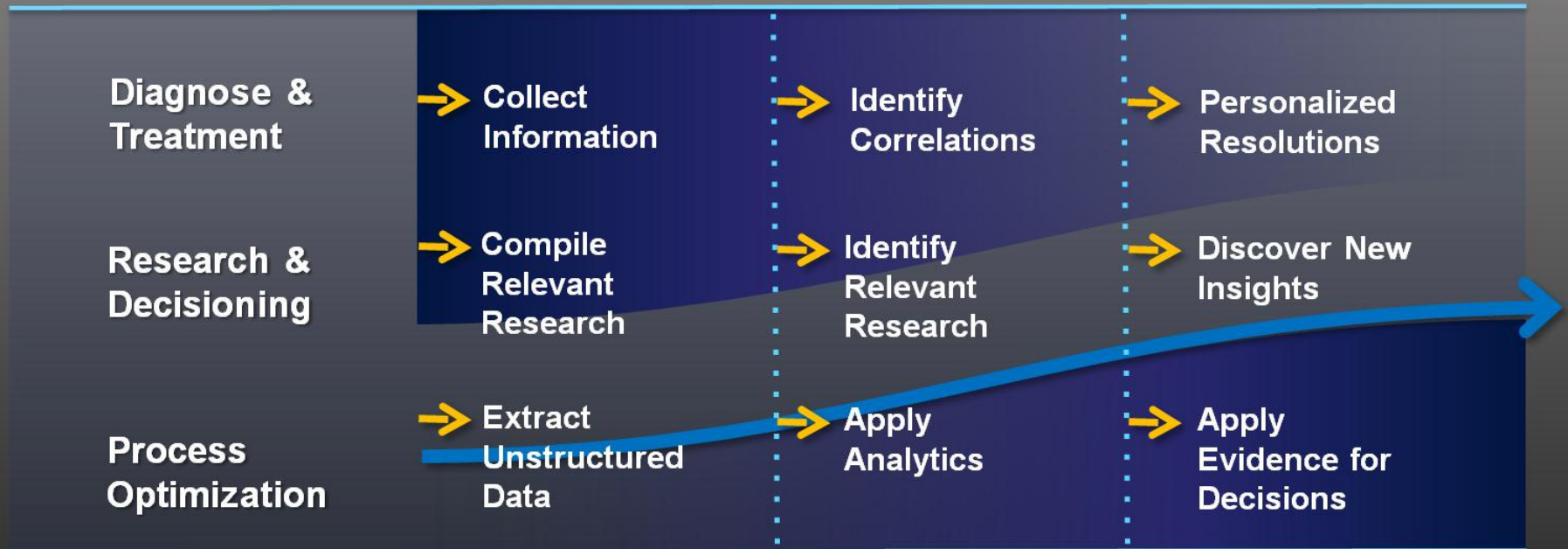


Getting Started on a Watson Solution

1 Manage Data

2 Analyze Patterns

3 Optimize Outcomes



“Ready for Watson” Progression Paths

From Battling Humans on Jeopardy! to Changing the Way the World Thinks, Acts, and Operates



Healthcare

Diagnostic/treatment assistance, evidenced-based insights, collaborative medicine



Financial Services

Investment and retirement planning, institutional trading and decision support



Contact Center

Call center and tech support services, enterprise knowledge management, consumer insight



Government

Public safety, improved information sharing, security, fraud and abuse prevention

IBM Watson has the capabilities to address grand business and societal challenges