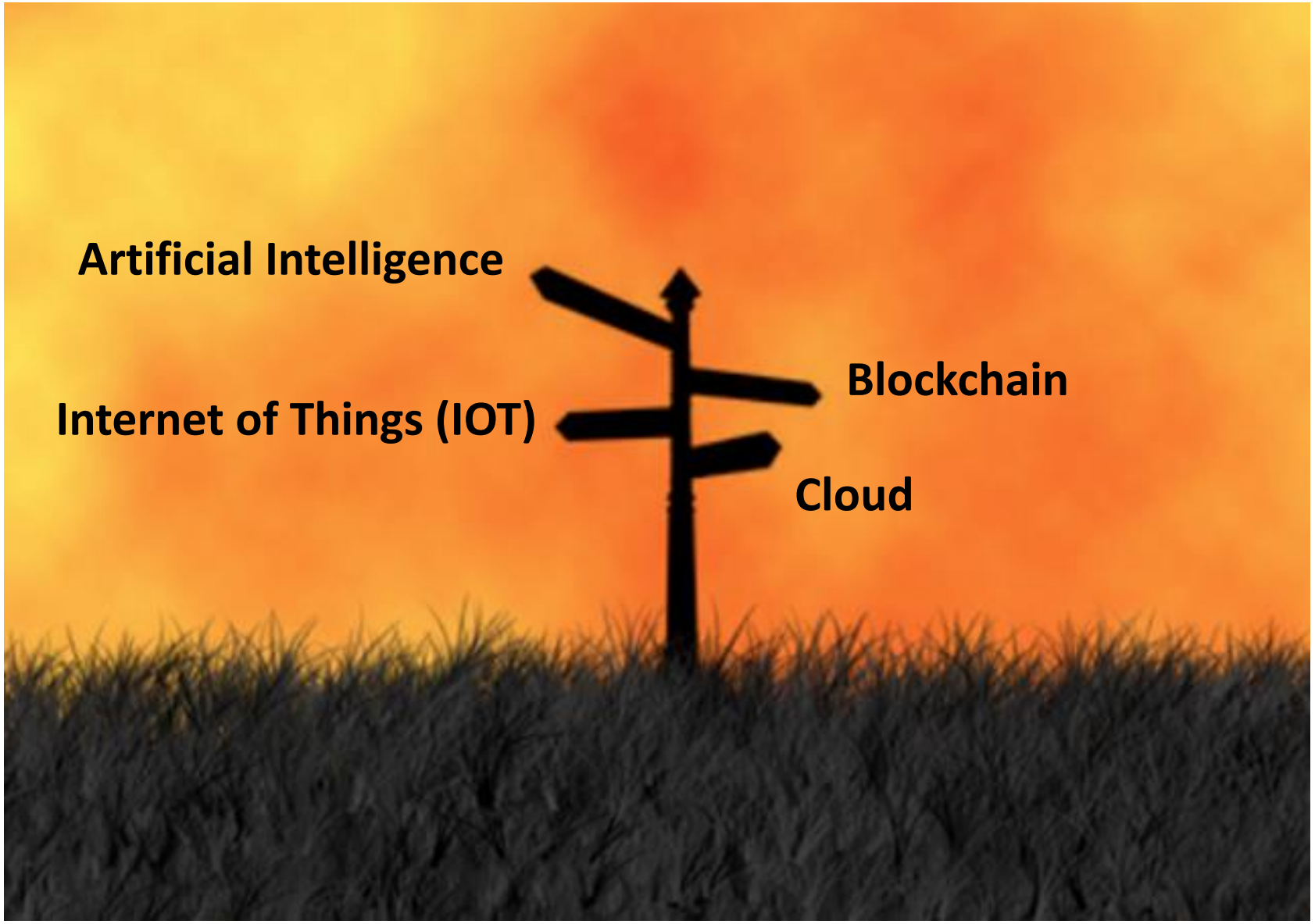
As quatro grandes tecnologias e o impacto na transformação da indústria de construção

Ulisses Mello, PhD

Director, IBM Research | Brazil

IBM Distinguished Engineer

The Big 4


Artificial Intelligence
Blockchain
Internet of Things (IOT)
Cloud

The evolution of Artificial Intelligence

Narrow AI
Emerging

Broad AI
Disruptive and Pervasive

General AI
Revolutionary

2010 and earlier

2015

▼ We are here

2050 and beyond

Artificial Intelligence

Narrow AI

Single task, single domain

Superhuman accuracy and speed for certain tasks

Broad AI

Multi-task, multi-domain

Multi-modal

Distributed AI

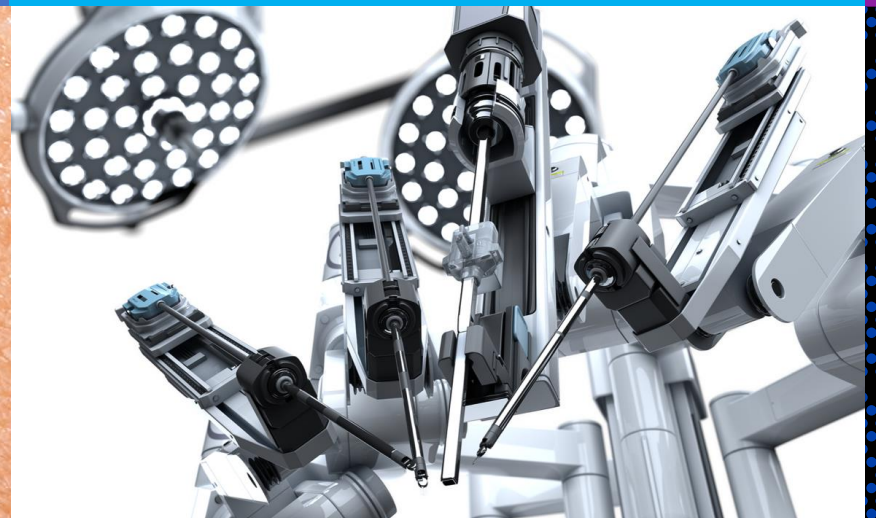
Explainable

Essential for enterprises

General AI

Cross-domain learning and reasoning

Broad autonomy



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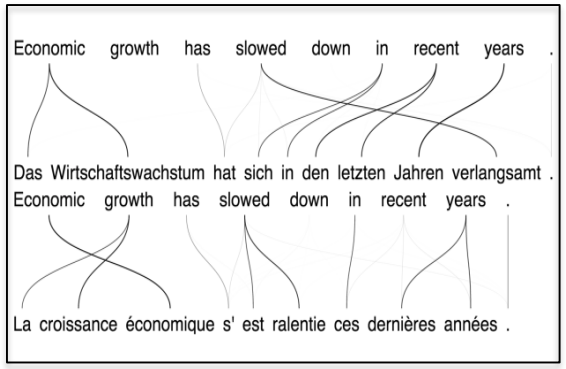
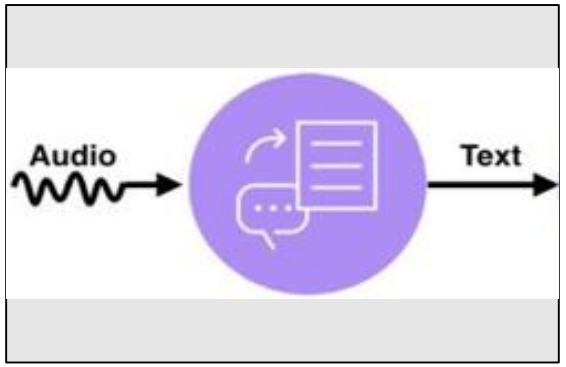
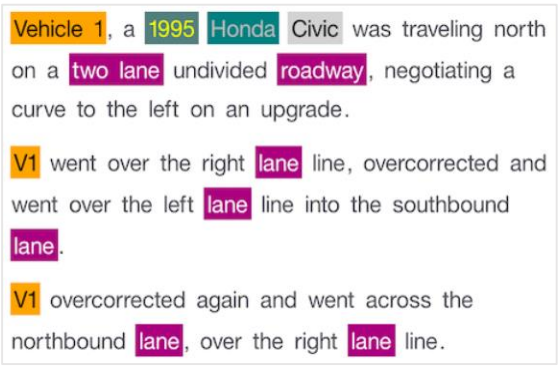
Narrow AI finally works!



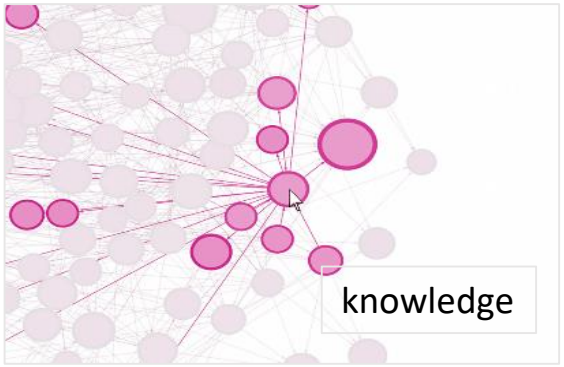
Language Translation



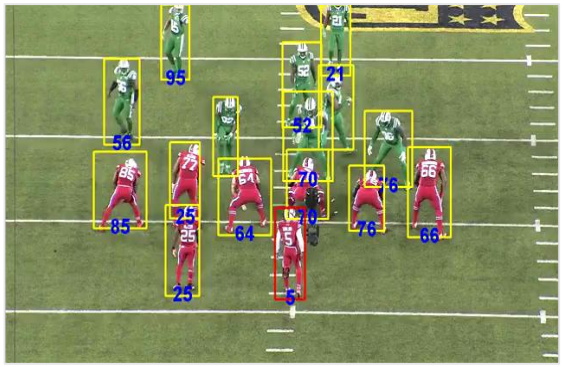
Speech Transcription



Language Understanding



Machine Reasoning



Object Detection

Face Recognition

Why AI now?

Confluence of factors

- Advances in computing HW
- Advances in AI algorithm(ML, DL)
- Data explosion

Cognitive Computing / AI is addressing key issues:

✓ Cognitive overload (data volume and pace)

✓ Recent advances in AI are poised to reduce the cost of analysis and prediction; helping improve decisions

✓ Economic theory tells us that as the cost of machine prediction falls, machines will do more and more prediction (Agrawal, Gans & Goldfarb, 2017, HBR)

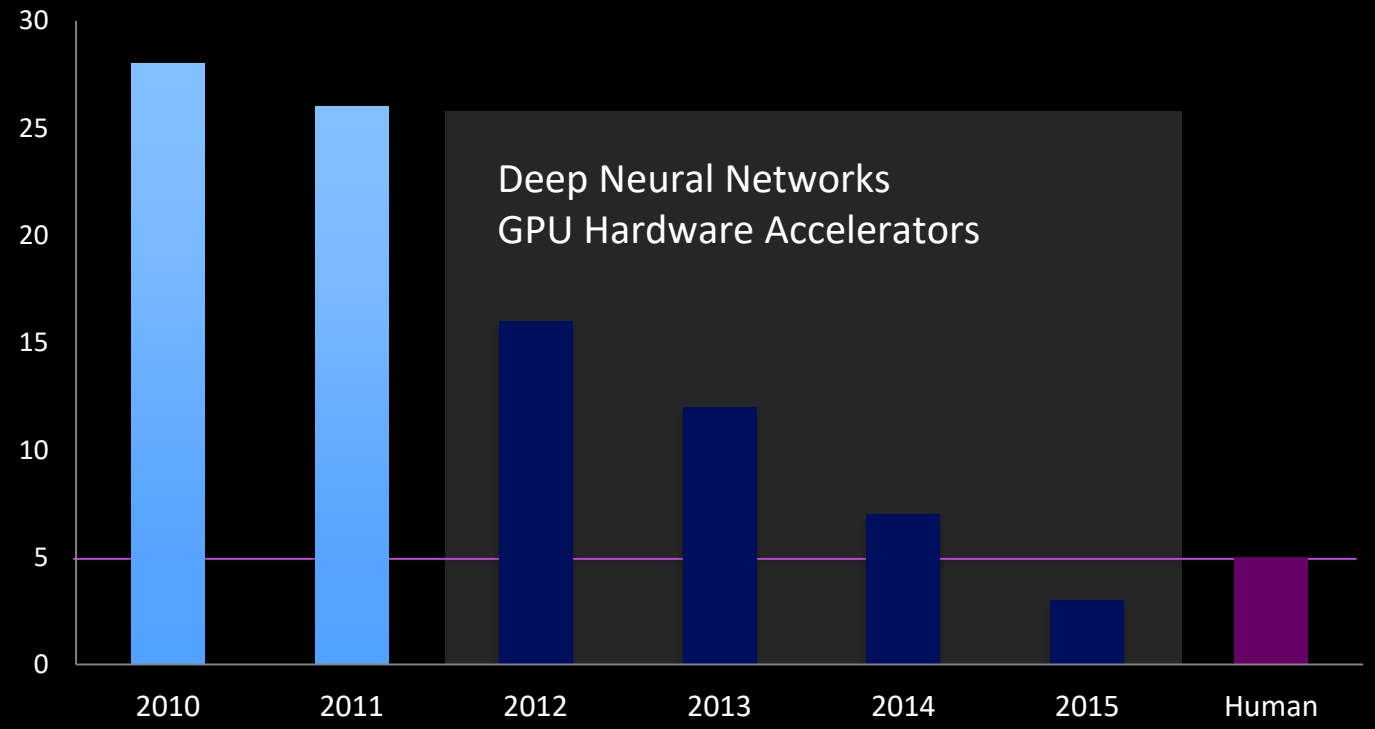
Economic theory also suggests that **AI will substantially raise the value of human judgment** which is key in decision making

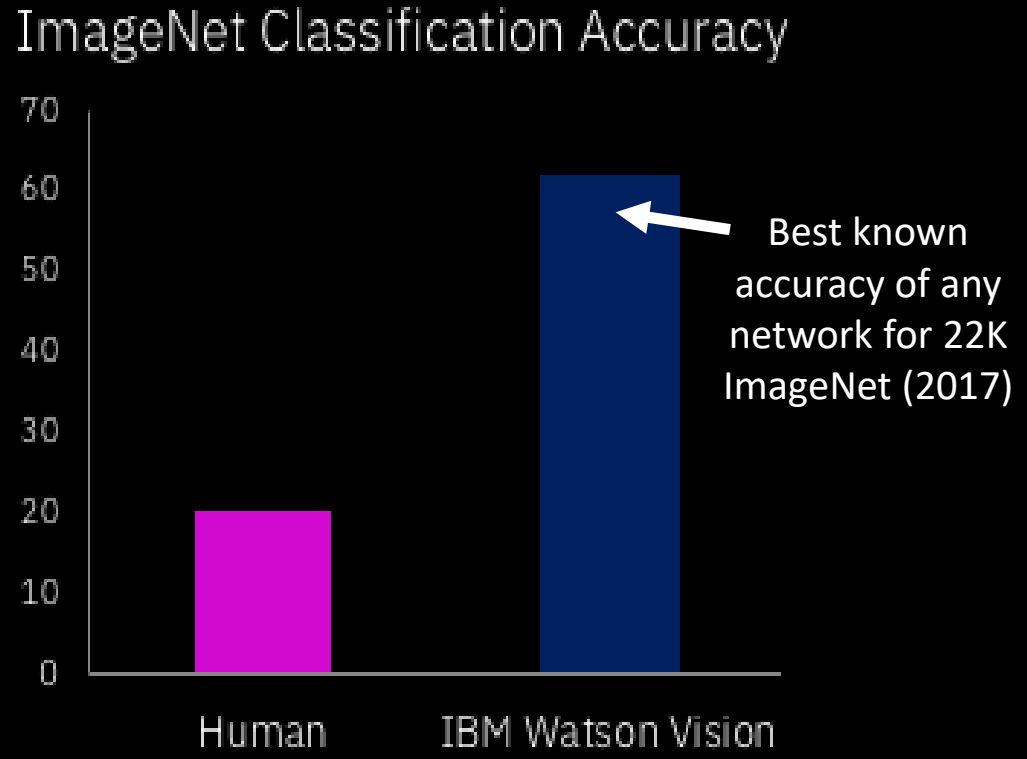
(AI=Augmented Intelligence)

Image classification

- Use of **Deep Neural Networks** and GPU **hardware accelerators** led to rapid error rate reduction

- ImageNet Classification Error (1000 objects)





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Learning What to See in Movies

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Scene

Movie

fixer-upper house	15.97
windshield wiper	12.49
bumper car	10.78
refrigerator	9.68
mansion house	9.33
plate	9.16
pedestrian crossing	8.27
wiper	7.92
flutist	6.67
contact	6.28
back of person	5.88
farmhouse	5.33
dwelling	4.73
intersection	4.69
forefather	3.94
driving wheel	3.79
sliding door	3.66
timepiece	3.41
pompadour hairstyle	3.31
male person	3.21
house	3.09
written document	3.02
paper	2.82
casing of building	2.58
shower curtain	2.52
telephone call	2.44
jamb (of door or window)	2.41
vehicle	2.40

Learning What to See and Hear in Movies

Visual Objects

21,841 WordNet Nouns:
(objects, people):

Animal, dog, monkey, building, car, boat, rail car, road, table, stone, tool, cross, coffin, etc.

IMAGENET

Visual Scenes

205 Visual Places
(context for object detection):

Street, field, forest, coast, staircase, cafeteria, castle, basement, bedroom, living room, etc.

Visual Sentiment

24 Sentibank Emotions
(facial expressions, affective response):

Joy, trust, fear, surprise, sadness, disgust, anger, anticipation, serenity, surprise, etc.

Visual Sentiment Ontology

Sound Emotion

18 Audio Sentiment
(speaker tone, music):

Anger, disgust, fear, happiness, sadness, aggressive, cheerful, nervous, tired, etc.

openSMILE:)
by audEERING™

Modeling the Creative Process for Making Trailers

Input → **Creativity** → **Output**

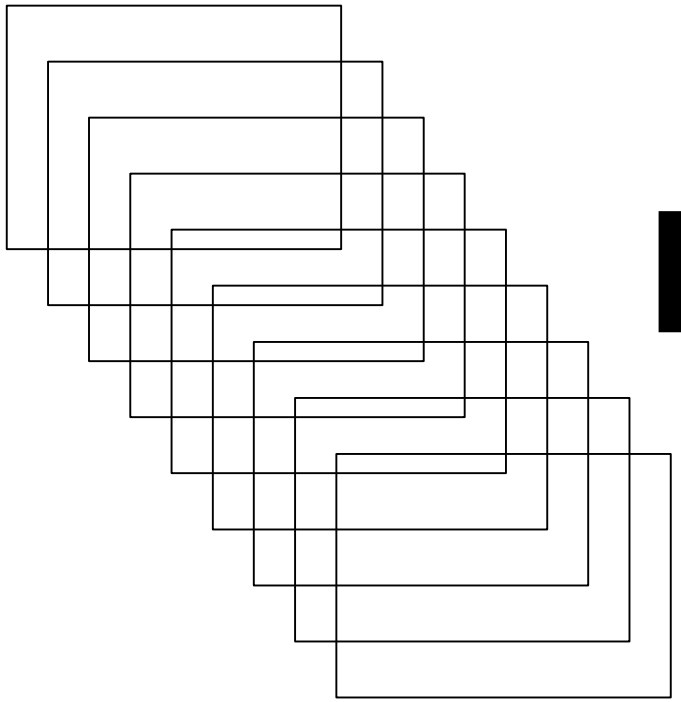
Movies

Trailers

IBM's Trailer for *Morgan* Took Less than One Day to Create

Morgan

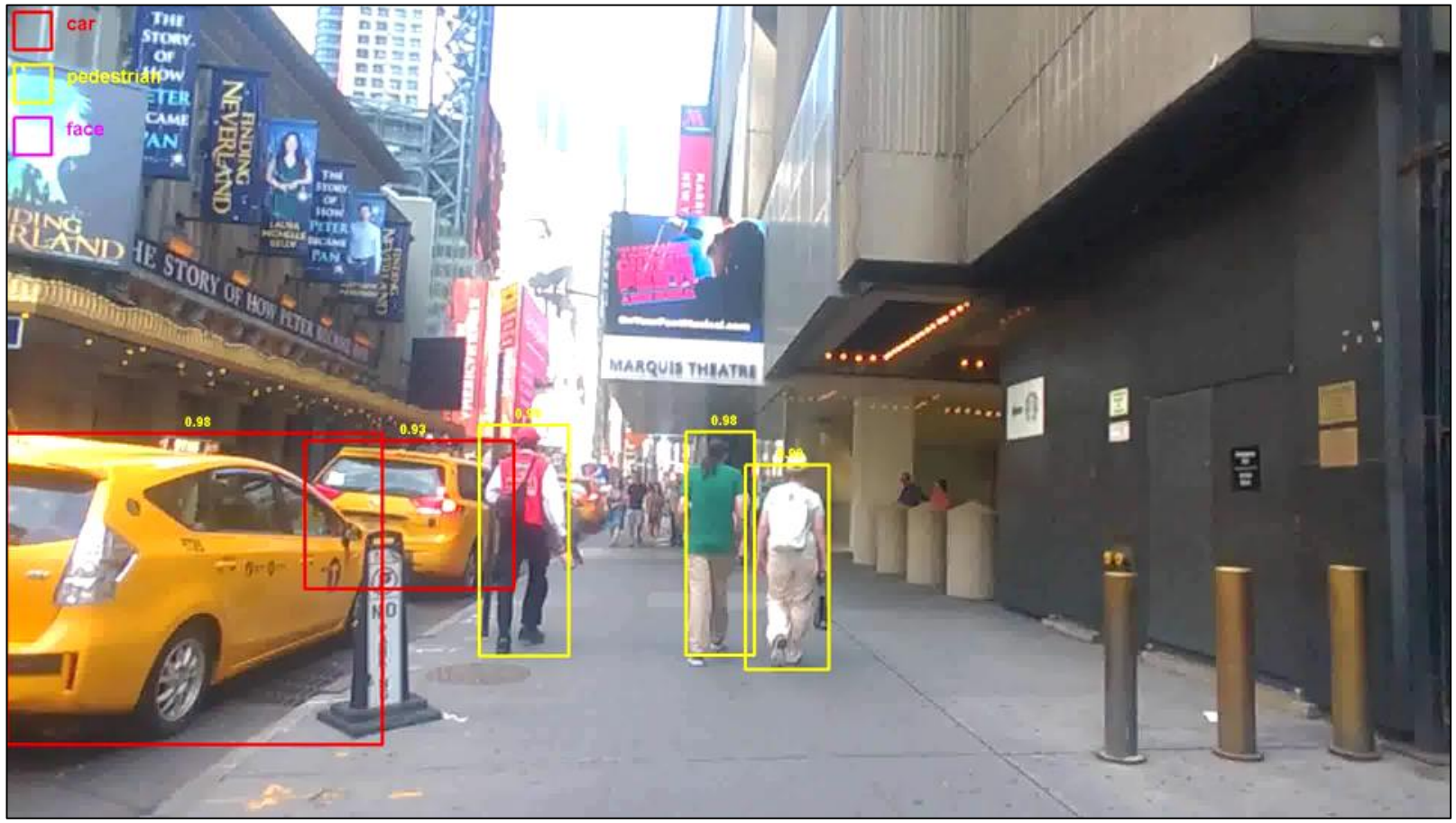
Top 10 Scenes



Movie Editor

Tender | ***Suspenseful*** | ***Scary***

Safety & Security



Car | **Pedestrian** | **Face**

Video Pedestrian Attributes

Clothing:
- Type
- Length
- Color
- Texture

Body Pose

Accessories:
- Backpack
- Umbrella
- Scarf
- Handbag

Video Face Attributes

Appearance
- Gender
- Age

Eye Region
- Eyewear

Head Region
- Exposure
- Hat
- Hair

Mouth Region
- Facial Hair

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Safety and Security

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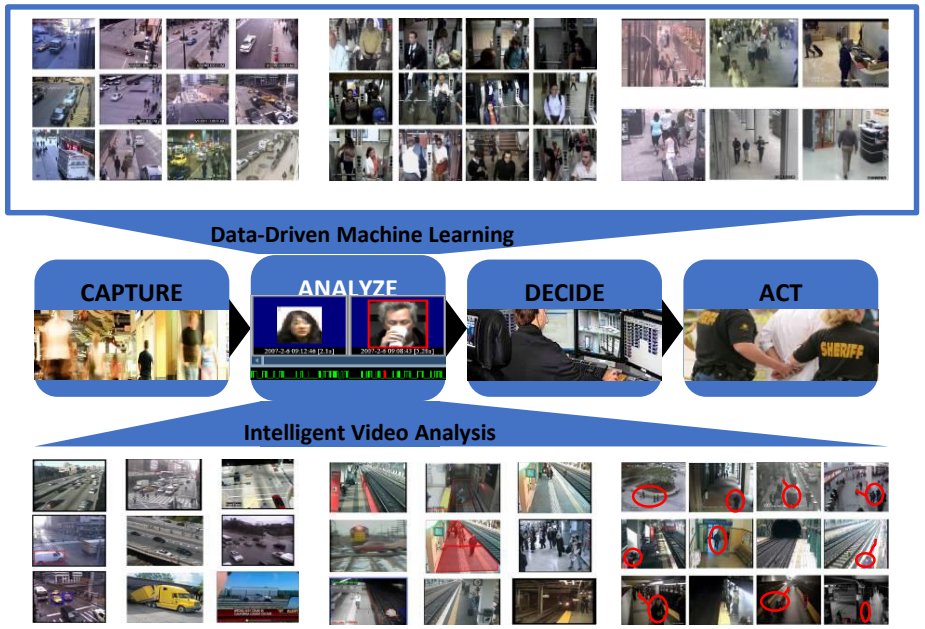
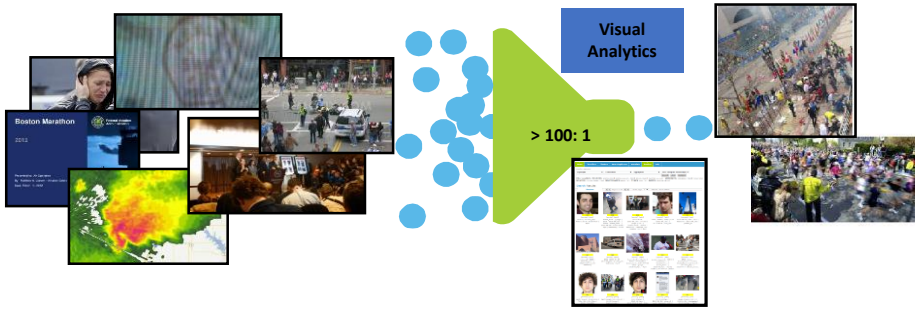
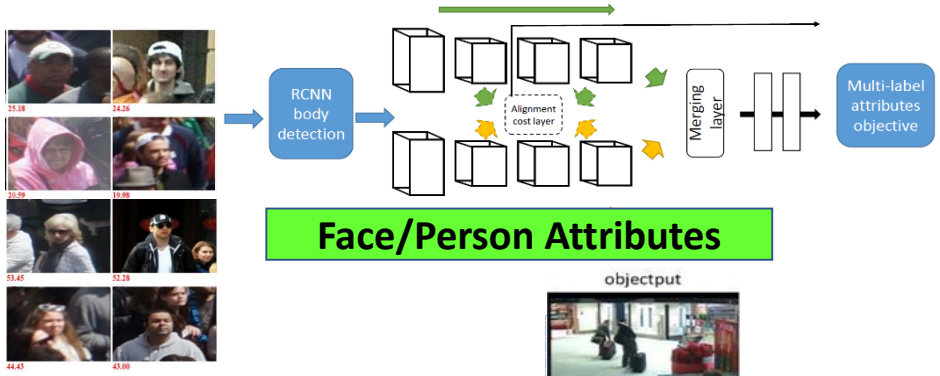
Intelligent Video Analytics (IVA)



IBM Multimedia Analysis and Retrieval System

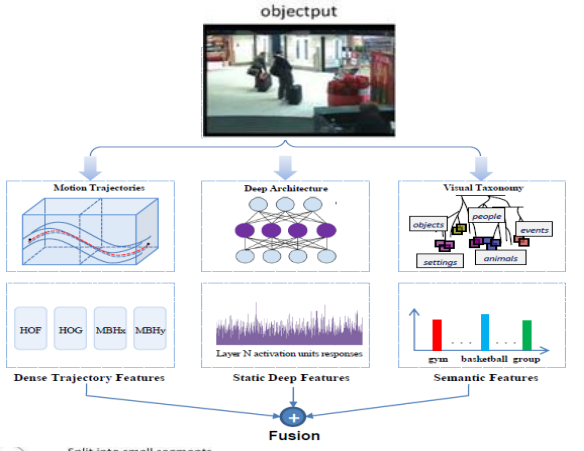


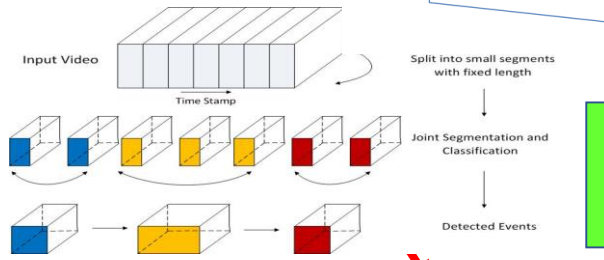
Mobile and Body Worn Cameras



Face/Person Attributes

Motion and Activity Analysis





Multi-modal Summarization

$$f(\mathbf{S},\mathbf{Y}) = \sum_{i=1}^{m} \underbrace{\varphi(\mathbf{y_i}|\mathbf{s_i})}_{(1)} + \mu \sum_{1\le k\le i-1}^{l} \underbrace{p(\mathbf{z_i}|\mathbf{z_{i-k}},\cdots,\mathbf{z_{i-1}})}_{(2)}$$

$\mathbf{X} = \{\mathbf{x}_1, \mathbf{x}_2, \cdots, \mathbf{x}_n\}$: a sequence of a video **X**
$\mathbf{S} = \{\mathbf{s}_1, \mathbf{s}_2, \cdots, \mathbf{s}_m\}$: random segmentation of sequence
$\mathbf{Y} = \{\mathbf{y}_1, \mathbf{y}_2, \cdots, \mathbf{y}_m\}$: event class labels

Wearable platform and industry analytics

Evolve our MobileFirst platform to leverage the transformational change taking place by wearable devices in the enterprise

- Wearable and IOT device connectivity via mobile (mobile-as-a-gateway)
- Ad-hoc computing in disconnect mode, on mobile-device analytics and business logic (mobile-as-a-hub)
- Multi modal interactions for seamless integrated user experience between wearables and mobile devices
- Understand people activities based on wearable enabled data

Employee Health and Safety

Employee safety and wellness kit enables the development of mobile applications that leverage wearable data and safety analytics.

Smart Mobile Worker

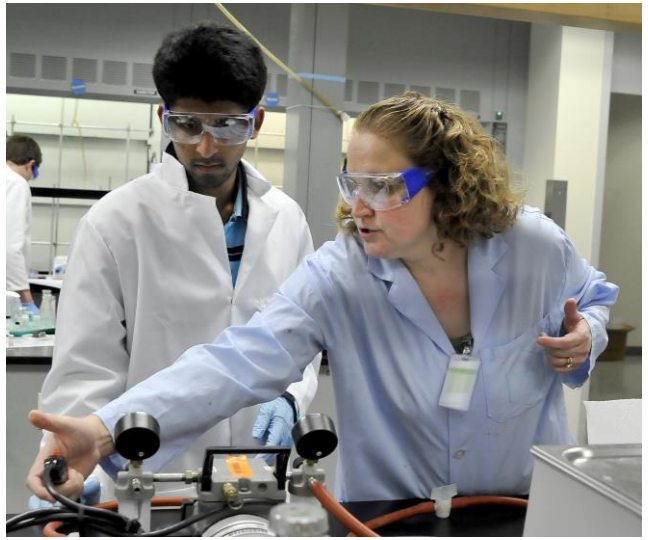
Enable mobile workers to use combination of wearable devices such as glasses, smart watches and gesture devices to interact with the computing systems and perform her tasks

Healthcare and Wellness

Drive cognitive health and wellness services via new exogenous data
Leverage wearable devices in Mobile HC/Wellness Solutions

Cognitive Visually Aware Technical Advisor

A Cognitive Visually Aware Technical Advisor is an integrated wearable cognitive system that sees and understands what the technician is doing (what he is looking at, what he is holding or pointing to, what actions he is executing) and exploits that derived situational context to allow the technician to ask human-oriented natural language technical questions and receive accurate and concise responses to support safe and efficient work flow



Augmented Reality & AI

Joe is a maintenance worker. He is sent to check a leaky connection on a pump flange. Joe is new at this site and has never worked on this unit before.

Joe knows that he should first check the torque on the flange bolts. He looks at the flange via his see-through smart AR glasses, points to the bolt (see finger pointing to bolt in the image) and asks:

1. Hey Watson, how tight should these be?

Watson processes the view from Joe's smart glasses camera and understands that Joe is pointing to a bolt on a flange located above the pump (Watson figures out the ID of the pump),and responds:

2. Joe, the torque on these bolts should be 27 ft-lbs

Joe checks the bolt torque and it is OK. He decides to replace the flange gasket, and asks:

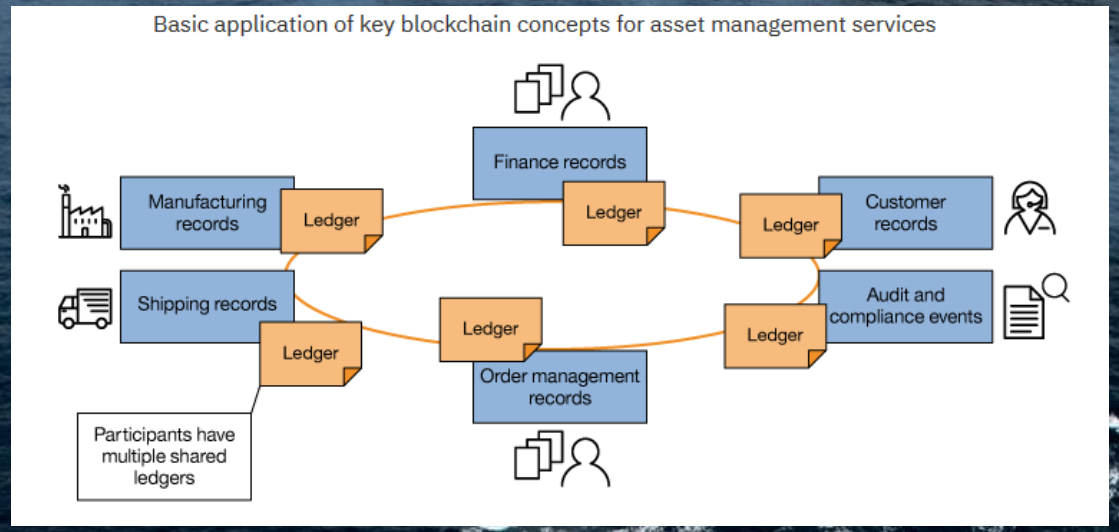
3. Hey Watson, what gasket type should I use here?

Watson remembers the context of what Joe is looking at (the flange) and looks up the correct type of gasket to use (based on material type flowing in pipe, pressure, temperature, etc…) and says…

4. Joe, Please use a THERMa-PUR Style 4122 Spiral Wound Gasket

5. Thanks Watson!

IBM Confidential Material



Global trade logistics with blockchain

90% of goods

in global trade carried by ocean freight

30 entities

involved in one typical shipment

1 lost document

can leave a container stuck in port for more than a month

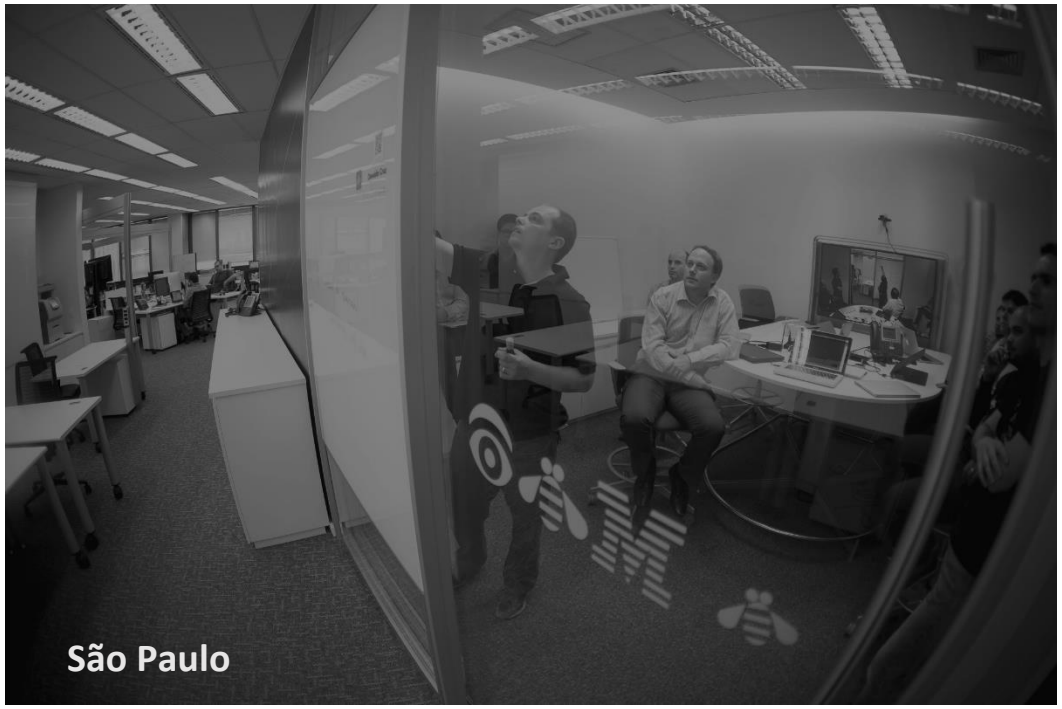
IoT

The Internet of Things in construction

The Internet of Things (IoT) used with analytics, mobile and cloud technologies has the potential to transform the engineering, construction and operations (EC&O) industry. Taking advantage of the IoT can transform building construction to make it more cost effective, sustainable and safe.

IOT-sensorização de um prédio em 4 horas

IBM Research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Strategic imperatives

Reimagining computing

Developing core AI

Transforming industries through science and AI

Defining and optimizing blockchain

Advances in hardware systems

March 20, 2018
Posted in: AI, Cloud Computing, IBM Research-Zurich, Systems

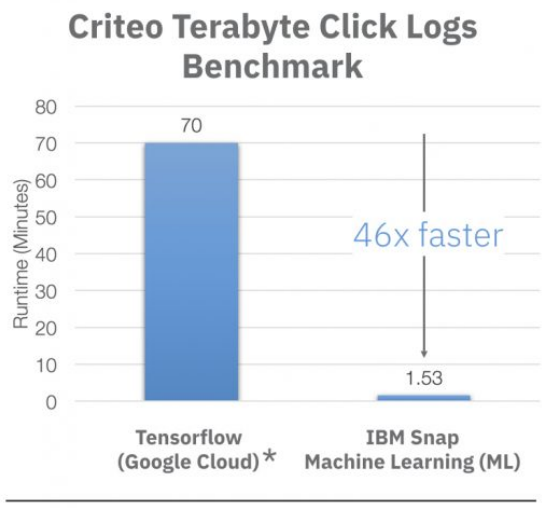
IBM Sets Tera-scale Machine Learning Benchmark Record with POWER9 and NVIDIA GPUs; Available Soon in PowerAI

Thomas Parnell and Celestine Dünner

Lead authors and researchers at IBM Resaerch - Zurich

Today, at IBM THINK in Las Vegas, we are reporting a breakthrough in AI performance using new software and algorithms on optimized hardware, including POWER9 with NVIDIA® V100™ GPUs.

In a newly published benchmark, using an online advertising dataset released by Criteo Labs with over 4 billion training examples, we train a logistic regression classifier in 91.5 seconds. This training time is 46x faster than the best result that has been previously reported, which used TensorFlow on Google Cloud Platform to train the same model in 70 minutes.



The AI software behind the speed-up is a new library developed over the past two years by our team at IBM Research in Zurich called IBM Snap Machine Learning (Snap

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IBM scientists demonstrate 10x faster large-scale machine learning using GPUs
Together with EPFL scientists, our IBM Research team has developed a scheme for training big data sets quickly. It can...

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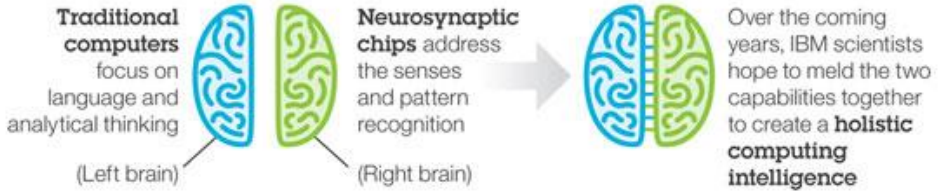
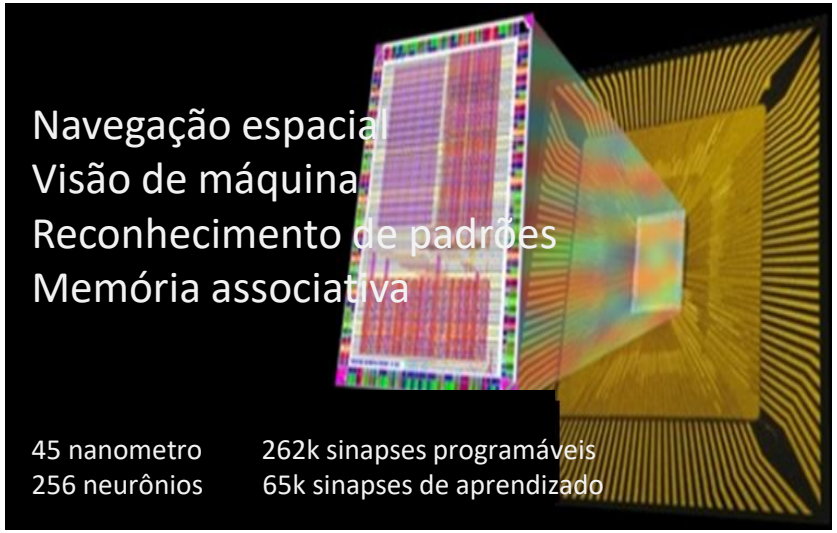
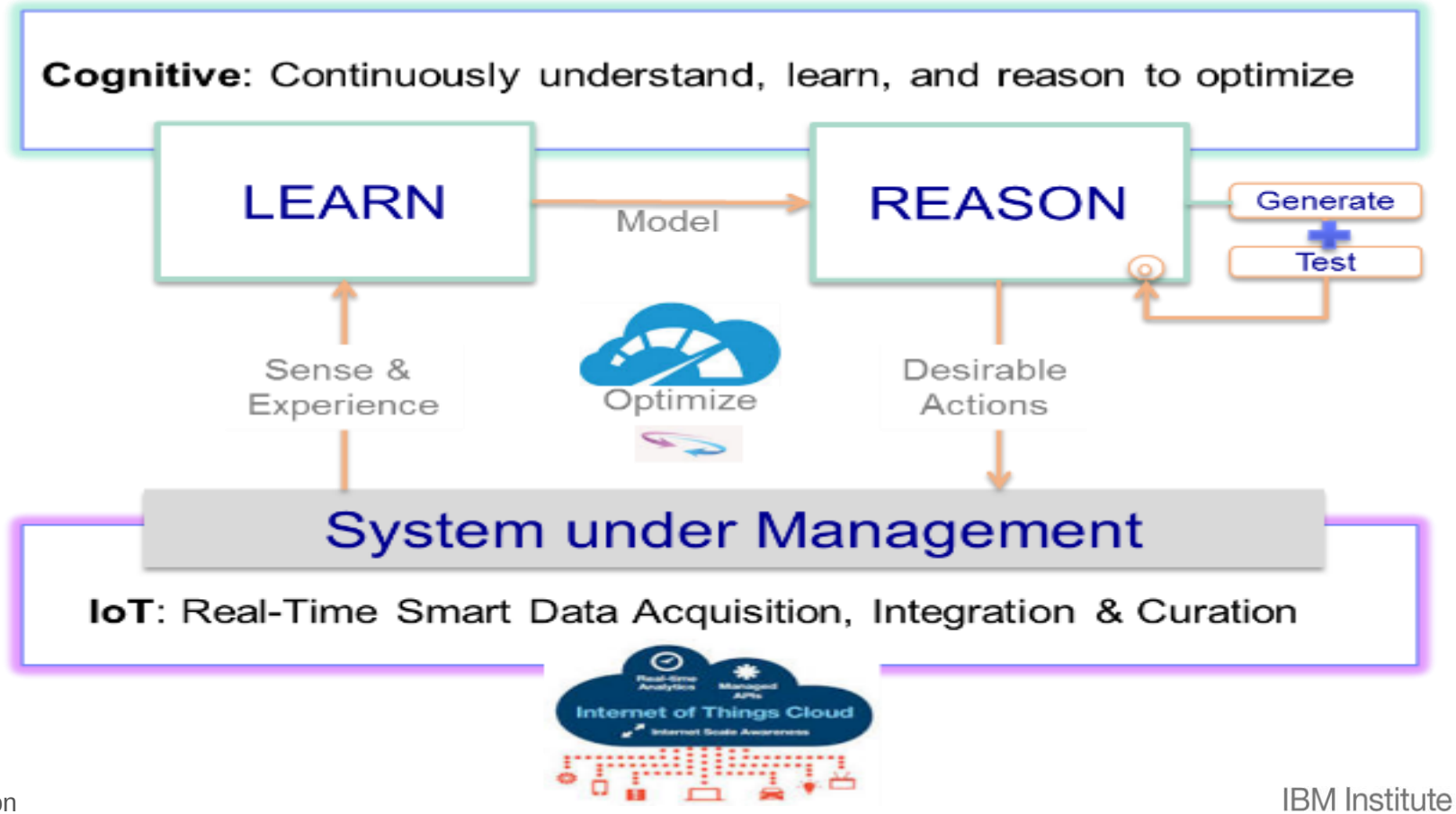
IBM Synapse
first chip for Learning Systems





Cognitive IoT is about changing outcomes

Cognitive IoT, much like a human, learns about a system and creates a model. It then reasons with this model to find the inputs to the system that will optimize its outcomes. In this way it can manage large cyber physical systems and transform industries, thereby creating cognitive businesses.



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We are working with clients to further enhance Watson IoT capabilities by leveraging emerging technologies

Wearables

IBM and a US steel producer have launched a pilot solution that watches worker locations, biometrics and environments over time, Spotting real-time risks with a cognitive Internet of Things on the factory floor.

Drones

IBM is helping a Drone manufacturer in the Netherlands by enabling drones with cognitive image-processing technology that has the potential to revolutionize cell tower inspection practices.

Robotics

IBM is working in partnership with several clients to provide our Cognitive capabilities on top of adaptive robots

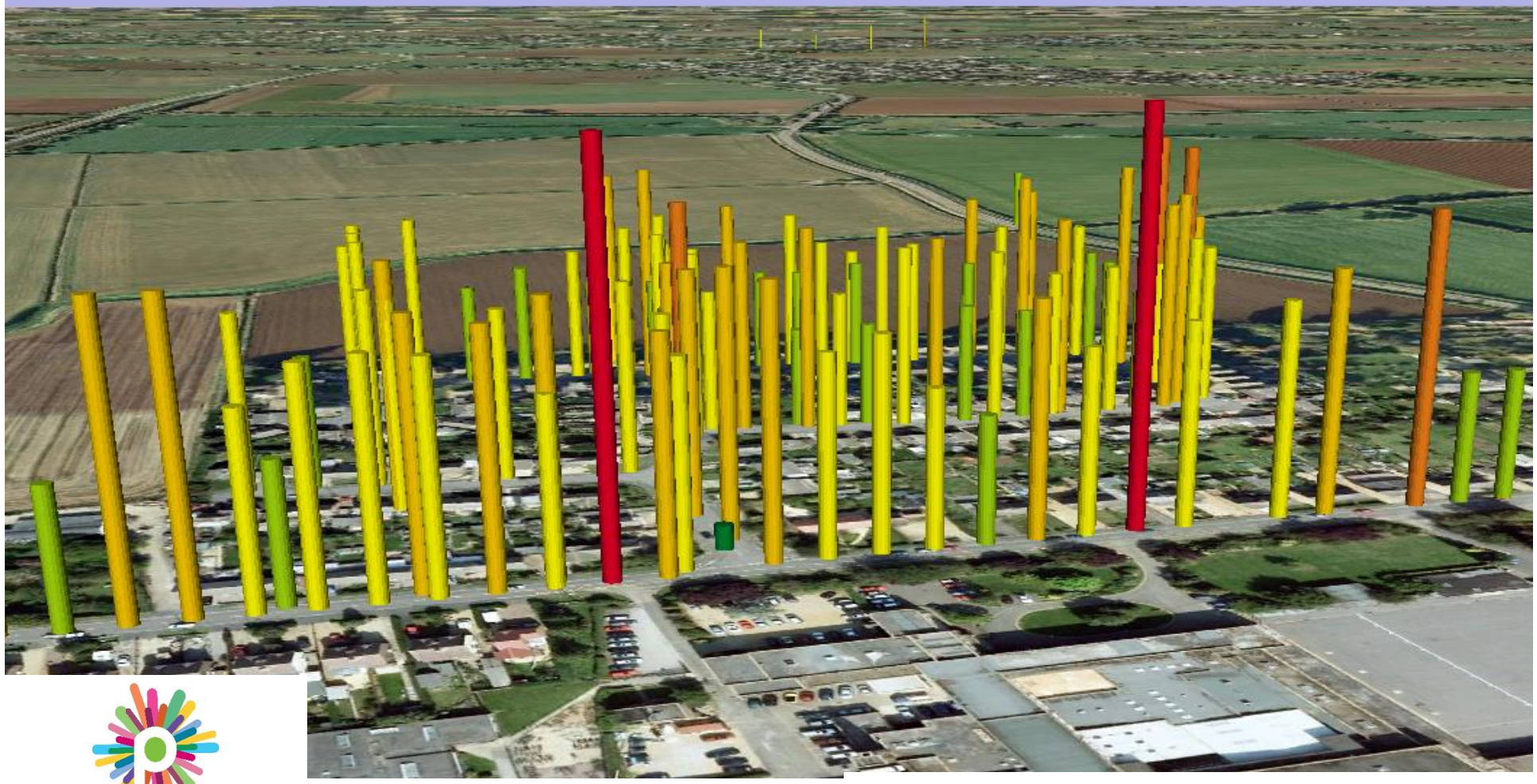
Virtual / Augmented Reality

IBM has been working over the past two years on AR/VR proof of concepts that go beyond the today's commercially available software. For example, multi object image recognition has use cases in planogram compliance and personalized shopping experiences.

Engaging and empowering citizens

IBM

Letting communities upload and visualise their own performance



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