

***Future Forum***

***Artificial Intelligence***

Mike Quindazzi

June 28, 2017



## ***Mike Quindazzi, Managing Director, PwC***

Mike has 28 years invested in gathering industry experience and crafting his management consulting abilities; **leading teams and global companies on strategy and transformational initiatives.**

Mike was just recognized by Analytica as a top 6 social media influencer for **Artificial Intelligence (AI)** in the world and top 6 for **Robotics**. In addition to serving clients, Mike currently serves on the executive committee at the LAEDC, leading a number of important economic development initiatives.

Mike will discuss the **global megatrends** leading to the rapid emergence of Artificial Intelligence in the last few years and the history over the past 70 years.

He will touch on the perception and impact of AI and robots on consumers and the workforce, and **the future of role of AI as a competitive force for business and nations** over the next two decades.

*Mike holds a Bachelor of Arts in Psychology from Montclair State University where he graduated Summa Cum Laude and was granted honorary membership from the Phi Kappa Phi Honor Society.*

*Please join Mike on Twitter to continue the conversation: @MikeQuindazzi and on LinkedIn: Mike Quindazzi.*

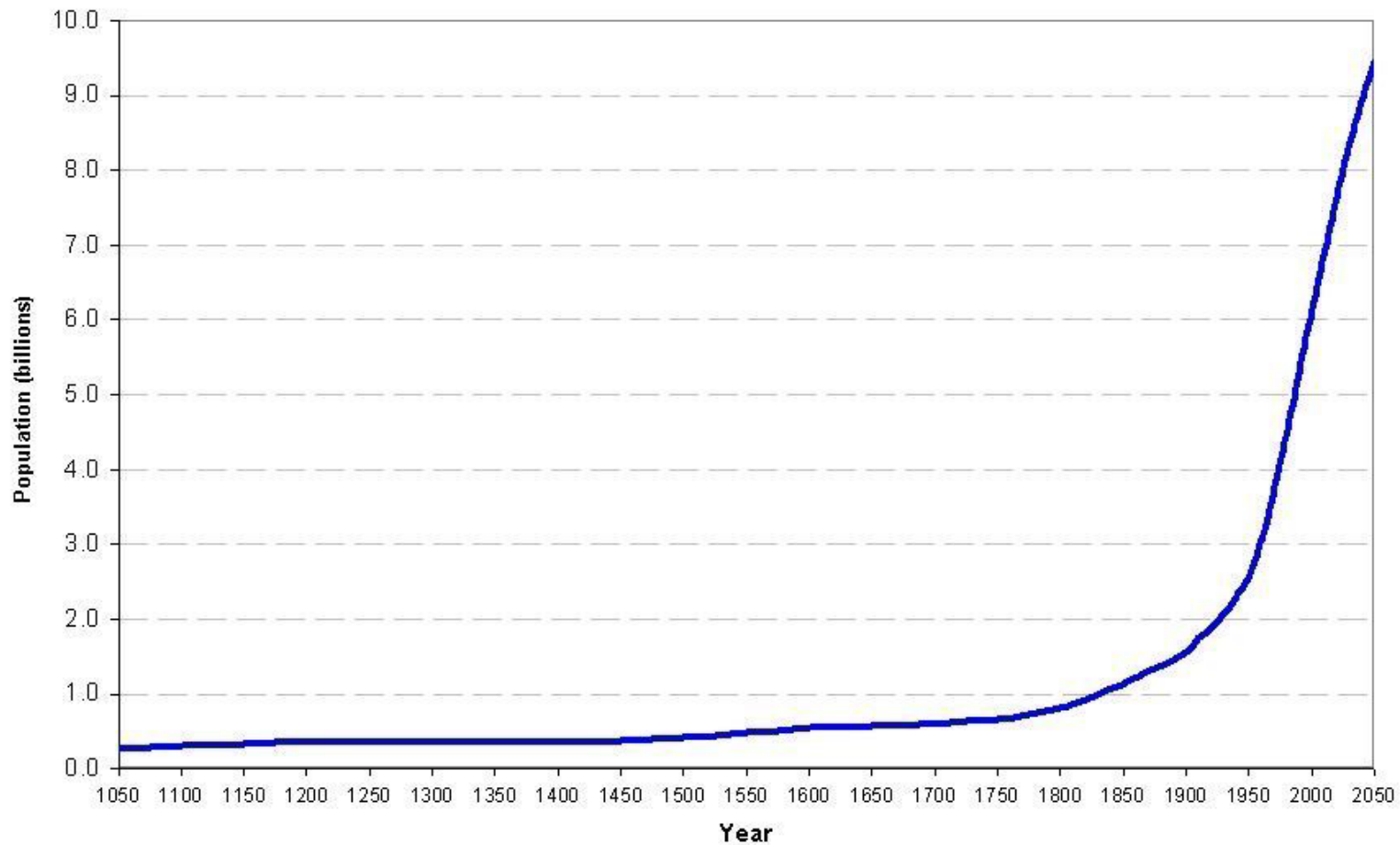


[linkedin.com/in/mikequindazzi/](https://www.linkedin.com/in/mikequindazzi/)



[@MikeQuindazzi](https://twitter.com/MikeQuindazzi)

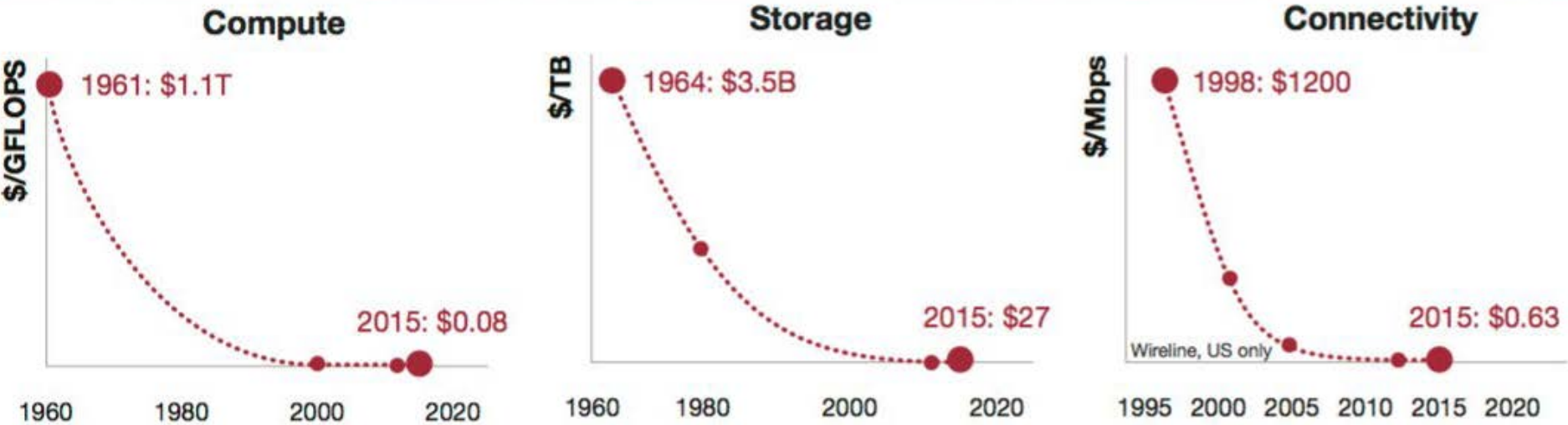
## World Population and Growth Rate



**Figure 2: GDP of G7 and E7 countries (US\$)**

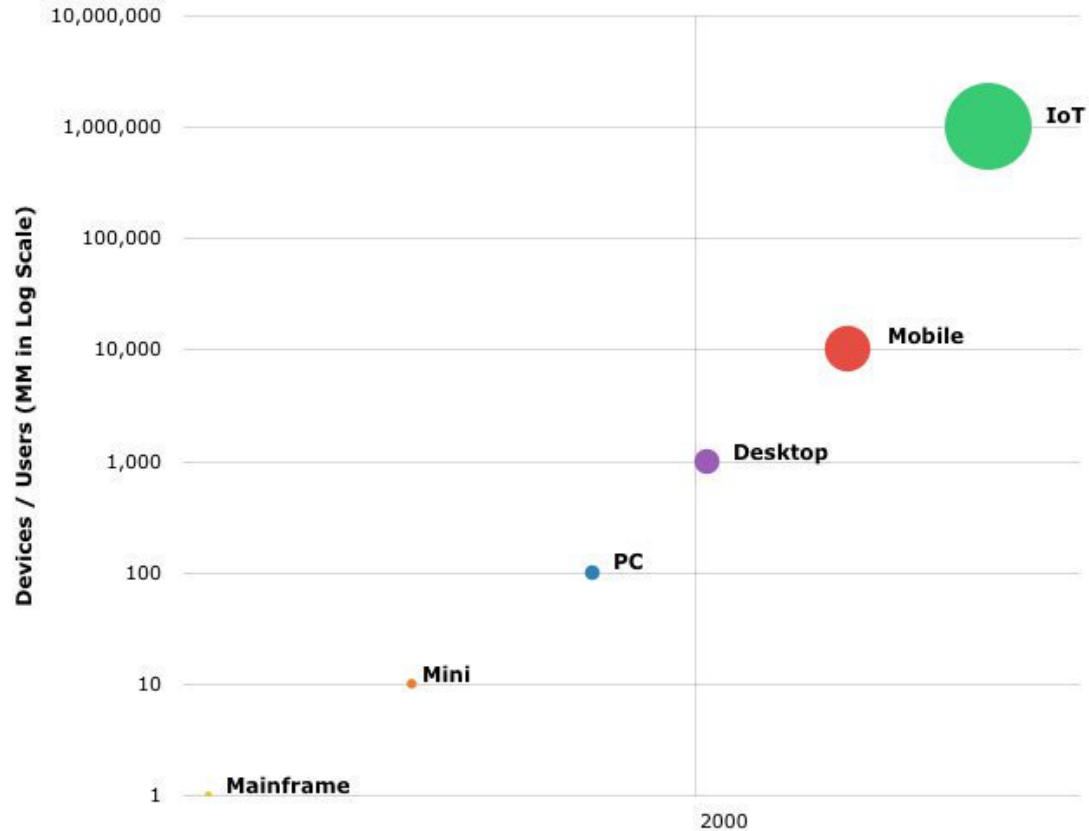


**Figure 2. Technology costs are plummeting (and the reach is increasing)**

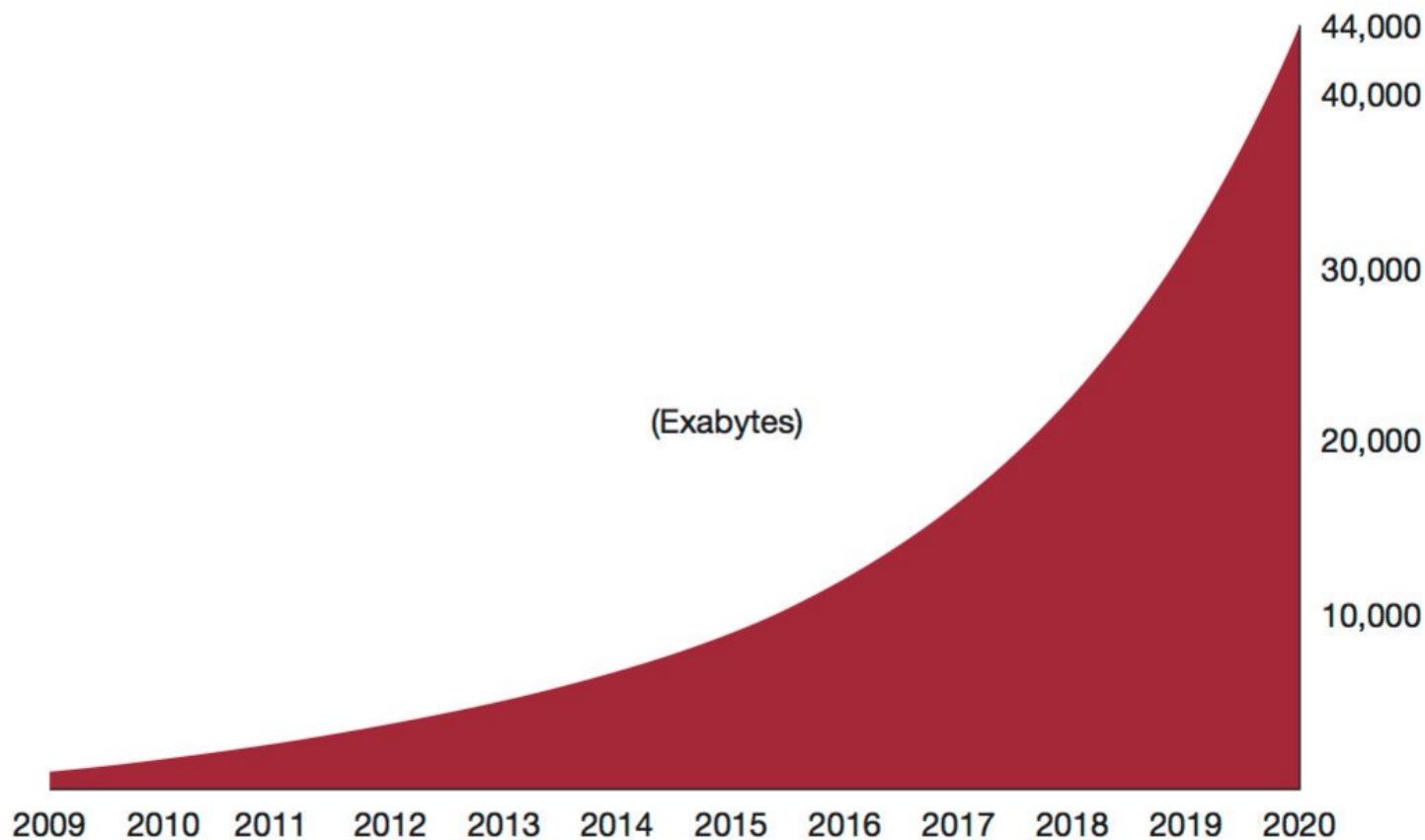


Source: PwC/Strategy& analysis; Michael Driscoll/Metamarkets

# Drivers of Semiconductor Growth, 1960-2030e



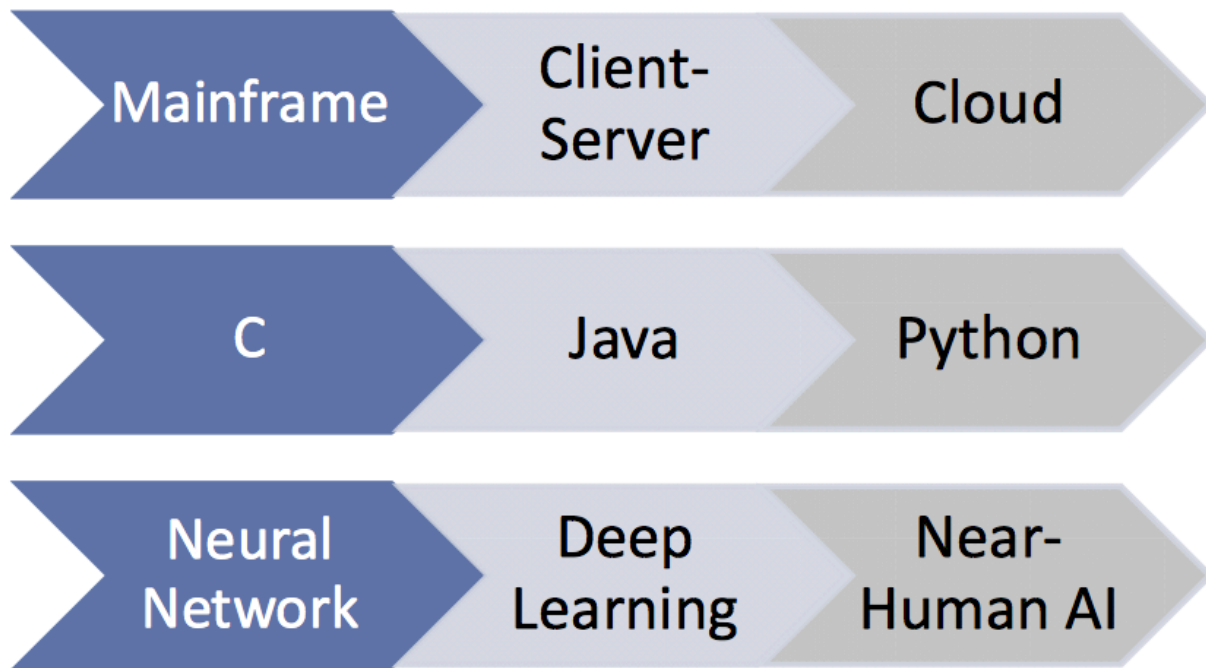
## Digital universe: 50-fold growth from 2010 through end of 2020



Source: IDC – The Digital Universe of Opportunities: Rich Data and the Increasing Value of the Internet of Things (2014)

source pwc china via @mikequindazzi

**Exhibit 15: AI advances can be compared to historical technological evolutions in systems architecture and programming language adoption, though we believe we are still in very early stages of development and adoption**

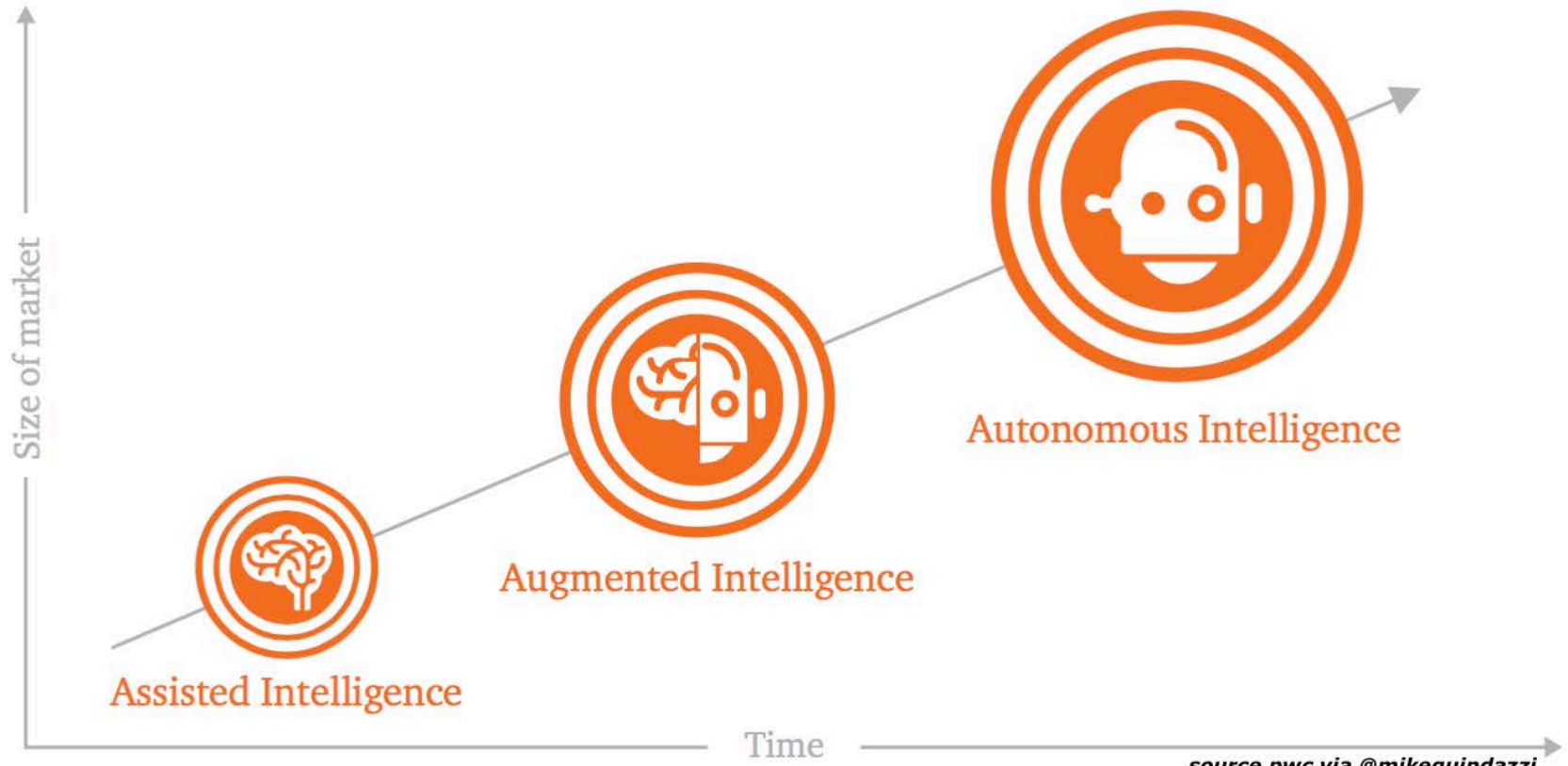


Source: Goldman Sachs Global Investment Research

source goldman sachs via @mikequindazzi



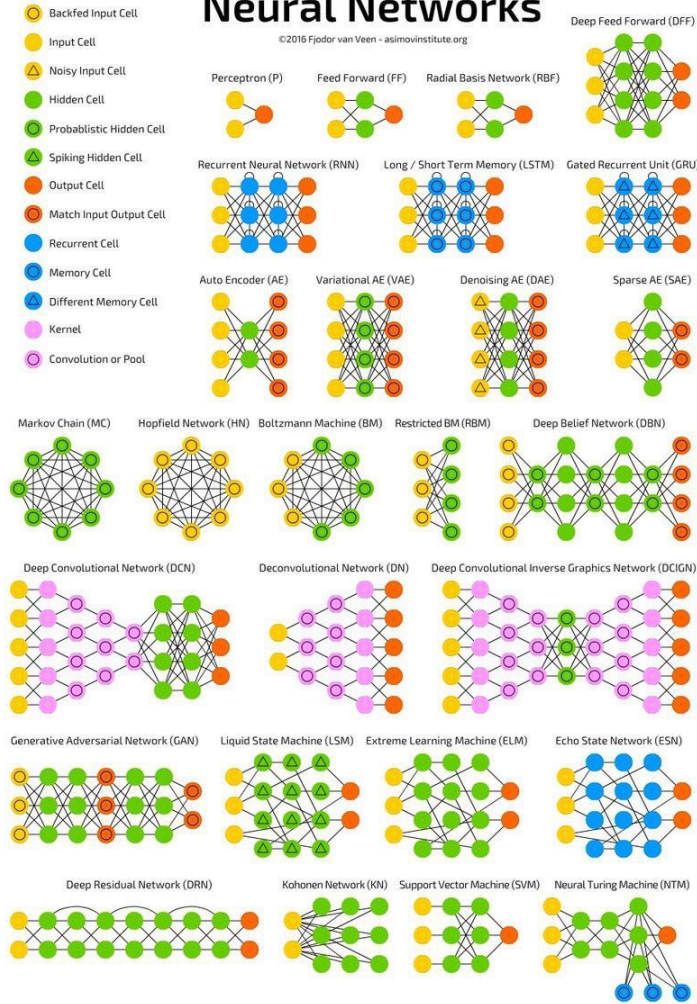
Figure 5: The expanding market potential of successive waves of AI



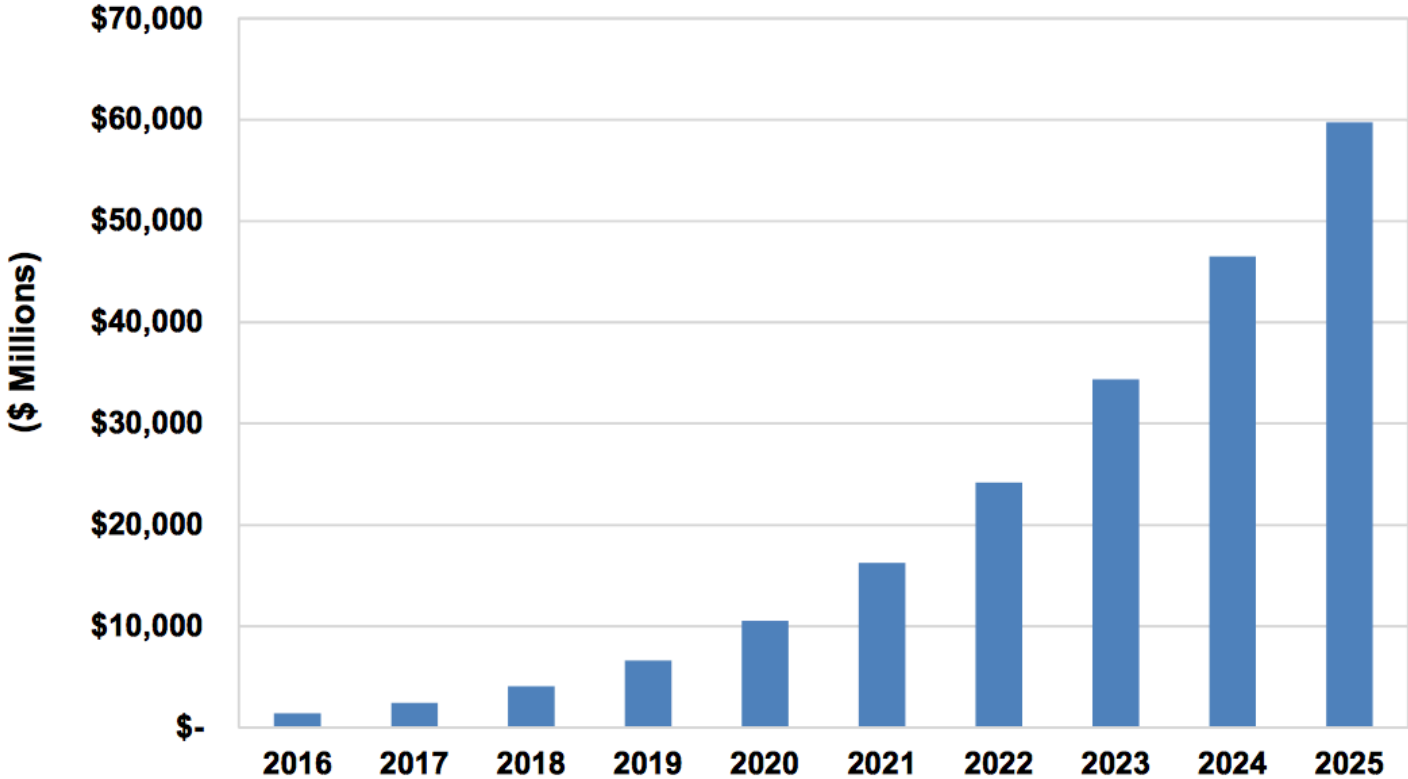
|                        |  <u>Insertion</u> |  <u>Selection</u> |  <u>Bubble</u> |  <u>Shell</u> |  <u>Merge</u> |  <u>Heap</u> |  <u>Quick</u> |  <u>Quick3</u> |
|--|---|---|--|---|---|--|---|--|
|  <u>Random</u>        |                  |                  |               |             |              |             |              |               |
|  <u>Nearly Sorted</u> |                  |                  |               |             |              |             |              |               |
|  <u>Reversed</u>      |                  |                  |               |             |              |             |              |               |
|  <u>Few Unique</u>    |                  |                  |               |             |              |             |              |               |

# Neural Networks

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**Chart 1.1 Artificial Intelligence Revenue, World Markets: 2016-2025**



*source tractica via @mikequindazzi*

## Less repetitive tasks = more big thinking

Business execs are eager to outsource the following tasks to a digital assistant, freeing up more time for deep thinking and creativity:



**82%**

Paperwork



**79%**

Scheduling



**78%**

Timesheets



**69%**

Accounting



**65%**

Personal expenses



**60%**

HR functions, like  
benefits



**60%**

Email management



**49%**

Proposal writing



**37%**

HR management

## Importance of AI being used to help solve:



**68%**

Cybersecurity  
and privacy



**66%**

Cancer and  
diseases



**62%**

Clean energy



**61%**

Personal financial  
security and fraud



**58%**

Global education



**56%**

Global health and  
well-being



**56%**

Economic growth



**50%**

Climate change



**38%**

Income inequality



**31%**

Gender inequality

At Amazon, we've been engaged in the practical application of **machine learning** for many years now. Some of this work is highly visible:

- Autonomous Prime Air delivery drones
- Amazon Go convenience store that uses machine vision
- Alexa cloud-based AI assistant

But much of what we do with **machine learning** happens beneath the surface.

- Drives our algorithms for demand forecasting
- Product search ranking
- Product and deals recommendations
- Merchandising placements
- Fraud detection
- Translations

Though less visible, much of the impact of **machine learning** will be of this type – quietly but meaningfully improving core operations.

Inside AWS, we're excited to lower the costs and barriers to **machine learning** and **AI** so organizations of all sizes can take advantage of these advanced techniques.

Using our pre-packaged versions of popular **deep learning** frameworks running on P2 compute instances (optimized for this workload), customers are already developing powerful systems ranging everywhere from:

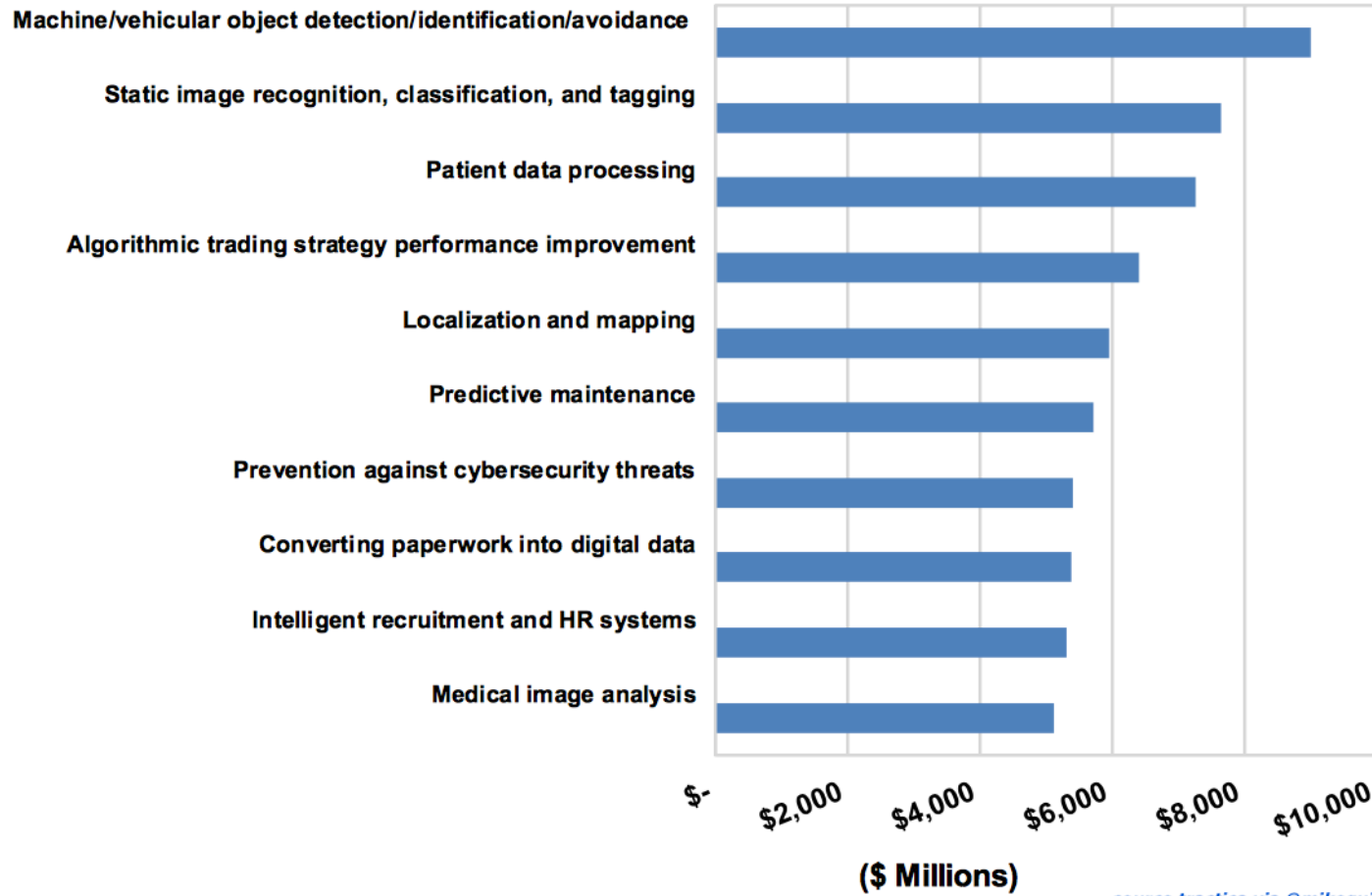
- Early disease detection
- Increasing crop yields

And we've also made Amazon's higher level services available in a convenient form.

- Amazon Lex (what's inside Alexa)
- Amazon Polly
- Amazon Recognition for NLP
- Speech generation
- Image analysis.

They can be accessed with simple API calls – no machine learning expertise required. Watch this space. Much more to come.

**Chart 1.2 Artificial Intelligence Revenue, Top 10 Use Cases, World Markets: 2016-2025**





**Exhibit 21: Horizontal AI-aaS Offerings and Pricing**  
 Sample of AI-aaS offerings from cloud platforms

| Company                              | Product  | Description  | Pricing (US)   |
|--------------------------------------|--|--|--|
| AMZN                                 | Machine Learning API   | Managed service for generating ML models and predictions; includes modeling APIs and batch/real-time prediction APIs | Data analysis and model building \$0.42 per compute hour; Batch Predictions \$0.10 per 1,000 predictions; Real-time \$0.0001 per prediction  |
| GOOGL                                | Vision API   | Image analytics tool   | Free to \$5 per 1k units depending on features used and monthly usage  |
|                                      | Google Cloud Machine Learning  | Managed services enables users to build machine learning models  | Training clusters: \$0.49/hour to \$36.75/hour depending on training units per hour<br>Prediction requests: \$0.05 to \$0.10 per 1k requests + \$0.40 per node hour depending on number of requests  |
|                                      | Speech API   | Converts audio to text   | 0-60 minutes free; 61-1mn minutes \$0.006 per 15 seconds   |
|                                      | Cloud Natural Language API   | Enables analytics of unstructured text   | 0-5k units free; above 5k pricing ranges from \$0.125 to \$1 per 1k units depending on features used and monthly usage.  |
|                                      | Translate API  | Translates and detects 90+ languages   | \$20 per mn characters   |
|                                      | Prediction API   | ML/predictive analytics tool   | Limited free use for 6mo; paid usage \$10/mo/project access fee, free predictions and streaming training up to 10,000 per day, additional predictions at \$0.50 per 1k predictions, additional streaming updates at \$0.05 per 1k updates. Training data \$0.002 per MB. |
| MSFT                                 | Computer Vision API  | Visual data analytics tool   | Free to \$1.50 per 1k transactions depending on monthly usage  |
|                                      | Emotion API  | Detects emotions in images   | Free to \$0.25 per 1k transactions depending on usage; free for video  |
|                                      | Face API   | Enables face detection with attributes and face recognition  | Free to \$1.50 per 1k transactions depending on monthly usage  |
|                                      | Text Analytics API   | Enables analytics of unstructured text   | Free to \$2,500 per month depending on usage   |
|                                      | Video API  | Advanced algorithms for tracking faces, detecting motion, stabilizing and creating thumbnails from video             | Free; 300 transactions per month per feature   |
|                                      | Bing Speech API  | Converts speech to text and back to speech, enabling app to "talk back" to users                                     | Free to \$4 per 1k transactions or \$5.5-\$9 per hour depending on type and usage  |
|                                      | Custom Recognition Intelligence Service  | Customized speech recognition tool   | Private preview by invitation only   |
|                                      | Speaker Recognition API  | Enables identification of speakers and speech as a means of authentication   | Free to \$10 per 1k transactions depending on usage and features used  |
|                                      | Bing Spell check API   | Contextual spell checking  | Free to \$450/month and overage at \$50 per 100k transactions depending on per month usage   |
|                                      | Language Understanding Intelligent Service (LUIS)                              | Teachs apps to understand commands from users  | Free to \$0.75 per 1k transactions depending on usage  |
|                                      | Linguistic Analysis API  | Natural language processing tools that identify structure of text  | Free; 5k transactions per month, 2 per second  |
|                                      | Web Language Model API   | REST-based cloud service providing tools for natural language processing   | Free to \$0.05 per 1k transactions depending on usage  |
|                                      | Academic Knowledge API   | Interprets user queries for academic intent and retrieves information from the Microsoft Academic Graph              | Free to \$0.25 per 1k transactions depending on usage  |
|                                      | Entity Linking Intelligent Services  | Contextualized language processing   | Free trial; 1k transactions per day  |
|                                      | Recommendations API  | Generates personalized product recommendations   | Free to \$5,000 per month depending on usage   |
| Bing Autosuggest API                 | Sends a partial search query to Bing and gets back a list of suggested queries | Free to \$270/month and overage at \$30 per 100k transactions depending on per month usage                           |  |
| Bing News/Image/Video/Web Search API | Sends a search query to Bing and gets back a list of relevant results          | Free to \$8,100/month and overage at \$30 per 10k transactions depending on per month usage                          |  |

# The Essential Eight technologies and how they can be applied

## Blockchain



Distributed electronic ledger that uses software algorithms to record and confirm transactions with reliability and anonymity. The record of events is shared between many parties and information once entered cannot be altered, as the downstream chain reinforces upstream transactions.

### Example Use Cases



- Identity management
- Voting
- Peer to peer transactions
- Supply chain management
- Smart contracting
- Provenance / traceability
- Asset registration / ownership
- Trade finance
- Record management

## Drones



Air- or water-based devices and vehicles, for example, Unmanned Aerial Vehicles (UAV), that fly or move without an onboard human pilot. Drones can operate autonomously (via on-board computers) on a predefined flight plan or be controlled remotely.

### Example Use Cases



- Insurance claim validation
- Precision farming
- Infrastructure inspections
- Railway safety
- Cargo delivery
- Construction site management
- Forestry management
- Facility inspection (wind turbine, oil rig, etc)

## Internet of Things (IoT)



Network of objects – devices, vehicles, etc. – embedded with sensors, software, network connectivity and compute capability, that can collect and exchange data over the Internet. IoT enables devices to be connected and remotely monitored or controlled. The term IoT has come to represent any device that is now “connected” and accessible via a network connection. The Industrial IoT is a subset of IoT and refers to its use in manufacturing and industrial sectors.

### Example Use Cases



- Inventory and material tracking
- Real-time asset monitoring
- Connected operational intelligence
- Customer self-service
- Usage and performance benchmarking
- Data integration and analytics
- Connected service parts management
- Remote service
- Real time market insights
- Flexible billing and pricing models

## Robots



Electro-mechanical machines or virtual agents that automate, augment or assist human activities, autonomously or according to a set of instructions – often a computer program.

### Example Use Cases



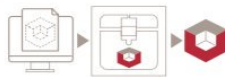
- Manufacturing
- Hazardous industries
- Hotels and tourism
- Service industry
- Automation of predictable tasks
- Data management

## 3D Printing



Additive manufacturing techniques used to create three-dimensional objects based on digital models by layering or “printing” successive layers of materials. 3D printing relies on innovative “inks” including plastic, and more recently, glass and wood.

### Example Use Cases



- Healthcare and smart medical devices
- Tools and end use parts
- Prototyping
- Bridge manufacturing
- Supply chain optimization
- Customized products
- Remote location production

## Virtual reality (VR)



Computer-generated simulation of a three dimensional image or a complete environment, within a defined and contained space, that viewers can interact with in realistic ways. VR is intended to be an immersive experience and typically requires equipment, most commonly a helmet/headset.

### Example Use Cases



- Immersive journalism
- Virtual workplaces
- Manufacturing/product design
- Architecture & construction
- Education&training
- Big data management
- Entertainment
- Healthcare
- Merchandising

## Augmented Reality (AR)



Addition of information or visuals to the physical world, via a graphics and/or audio overlay, to improve the user experience for a task or a product. This “augmentation” of the real world is achieved via supplemental devices that render and display said information.

### Example Use Cases



- Virtual showrooms
- Education
- Travel and tourism
- Gaming
- Printing and advertisers
- Retail environments
- Marketing

## Artificial intelligence (AI)



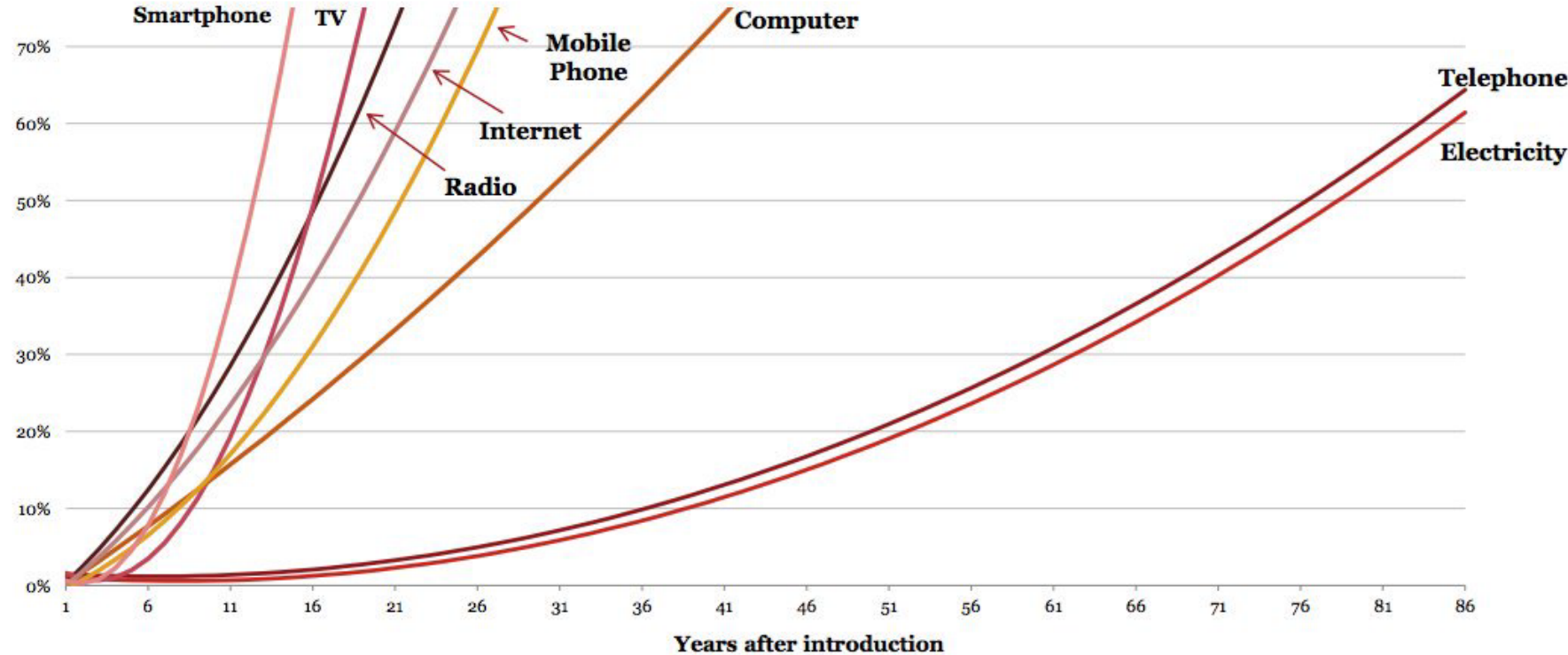
Software algorithms that are capable of performing tasks that normally require human intelligence, such as visual perception, speech recognition, decision-making and language translation. AI is an “umbrella” concept that is made up of numerous subfields, such as machine learning, which focuses on the development of programs that can teach themselves to learn, understand, reason, plan, and act (i.e. become more intelligent) when exposed to new data in the right quantities.

### Example Use Cases



- Managing personal finances
- Trading systems
- Real time fraud and risk management
- Automated virtual assistants
- Underwriting loans and insurance
- Customer support, transactions and helpdesks
- Data analysis and advanced analytics

**Years it takes technology to be adopted by x% of US population**



Source: PwC analysis based on “Are Smart Phones Spreading Faster than Any Technology in Human History?”, MIT Technology Review (2012). Note: Market penetration is percent of US households (telephone, electricity, radio, TV, internet) or per cent of US consumers (smart phone, tablet). *source pwc via @mikequindazzi*

Featured speaker on the **global megatrends** and emerging **AI technologies** in the enterprise!



Los Angeles County Economic Development Corporation's

# FUTURE FORUM

ARTIFICIAL INTELLIGENCE  
& ROBOTICS

**JUNE 28, 2017**

7:30 AM - 10:30 AM

Presented by



California State University  
**DOMINGUEZ HILLS**

Mike Quindazzi, Managing Director at PwC, recognized globally as top 6 social media influencer for **Artificial Intelligence** and top 6 for **Robotics** by Analytica.



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