THINKLab

Artificial Intelligence and Innovation in Healthcare

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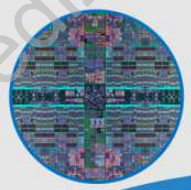
The next revolution is to **augment human cognition**



Cognitive Era

Augmenting Human Intelligence

- Learn at scale
- Reason with purpose
- Interact naturally with us

Information and Telecom

Oil, Automobiles and Mass Production

Steel, Electricity and Heavy Engineering

Steam and Railways

The Industrial Revolution

1700

Today

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Source: Adapted from the work of Carlota Perez

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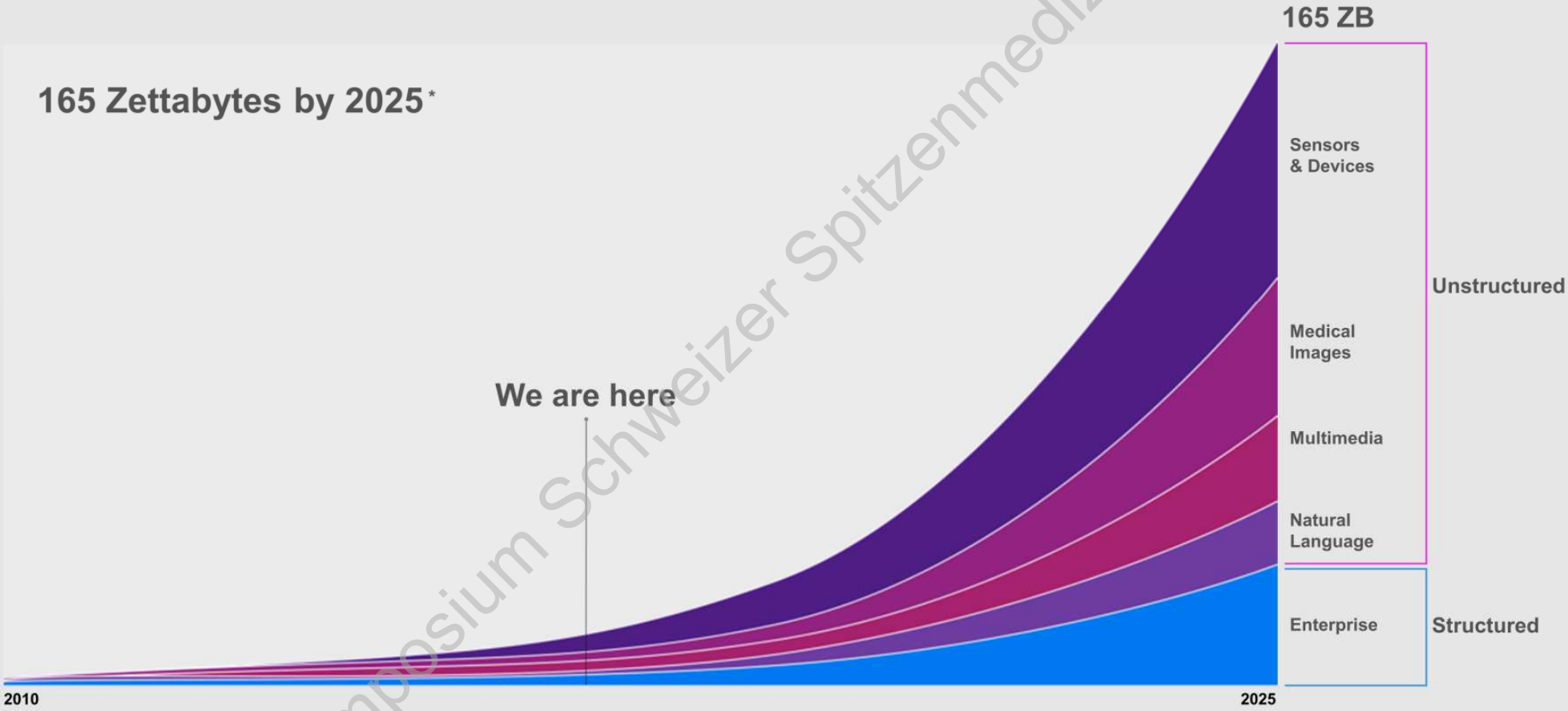
Data is growing exponentially and demands **new approaches**



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*Source IDC. IBM projections based on analyst report

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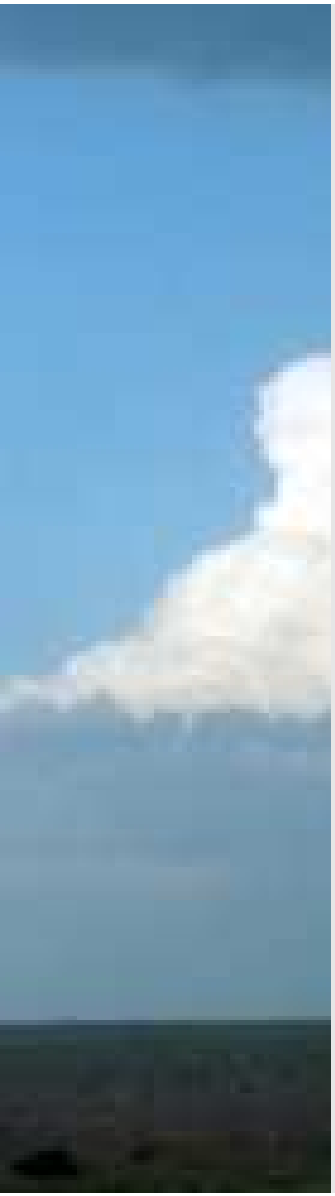

Unstructured data — “dark data” — accounts for 80% of all data generated today.

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Cognitive computing uses **all types of data**

Own data

- Customer records
- Transactional systems
- Predictive models
- Institutional expertise
- Operational systems

External data

- News
- Events
- Social media
- Weather
- Geospatial information

Arriving data

- Internet of Things (IoT)
- Sensory data
- Images
- Video

Structured and active — **Unstructured and dark**

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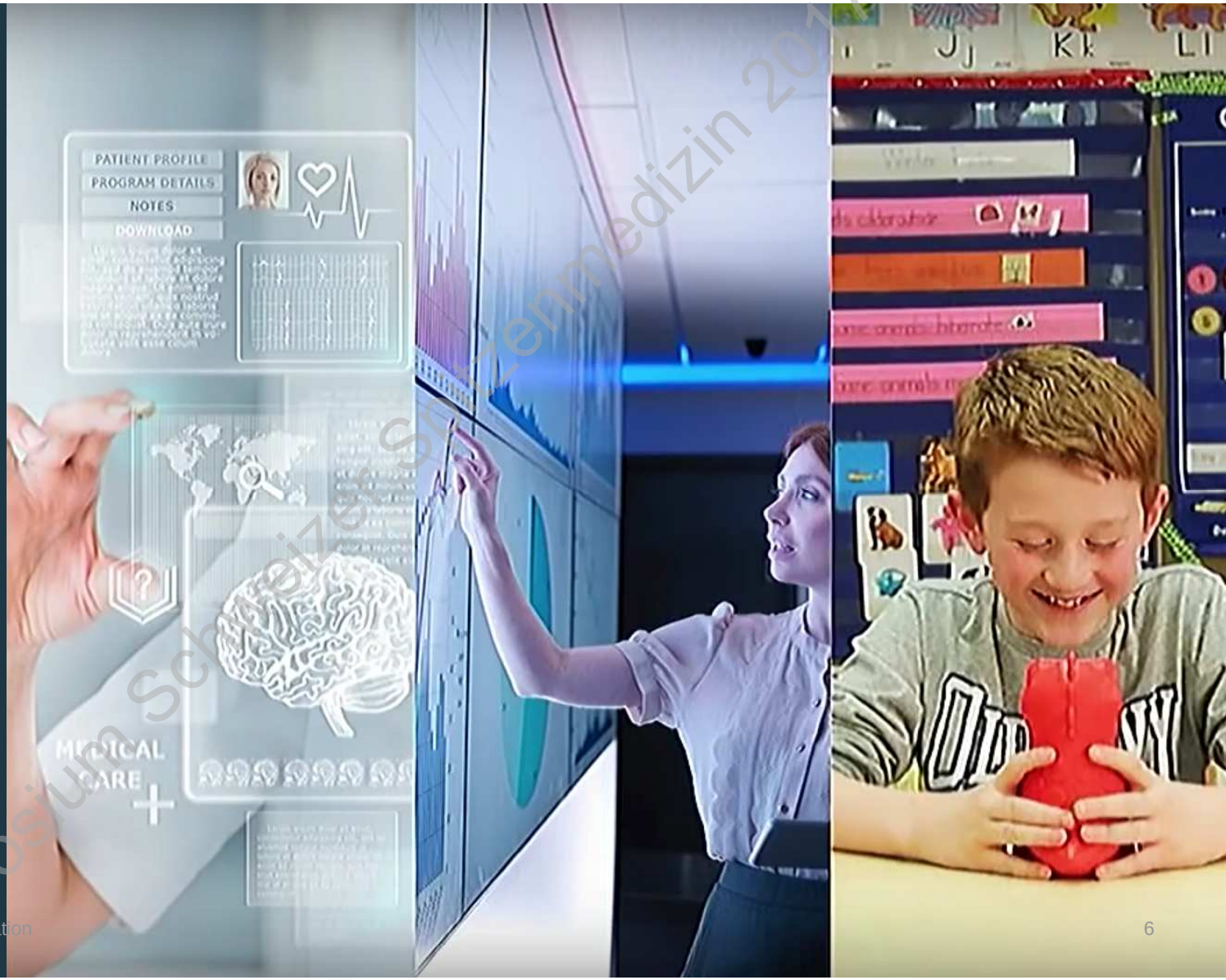
Cognitive systems must learn at scale, reason with purpose, and interact with humans naturally.



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Collaborating with clients across industries to solve hard problems

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Empowering the Oncology Community for Cancer Care: 35+ Hospital Systems

Illumina

Broad Institute

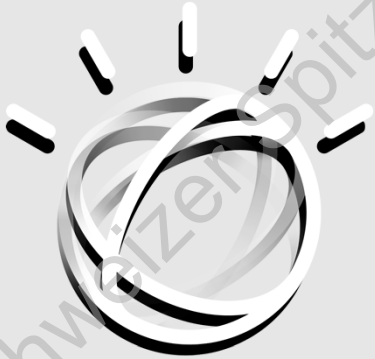
Best Doctors

UNC Lineberger

U.S. Department of Veterans Affairs

Froedtert & Medical College of Wisconsin

Mayo Clinic



Genomics

Clinical Trial Matching

Oncology

Quest Diagnostics

New York Genome Center

Memorial Sloan Kettering Cancer Center

Bumrungrad International Hospital

Manipal Hospitals

Gachon University Gil Medical Center

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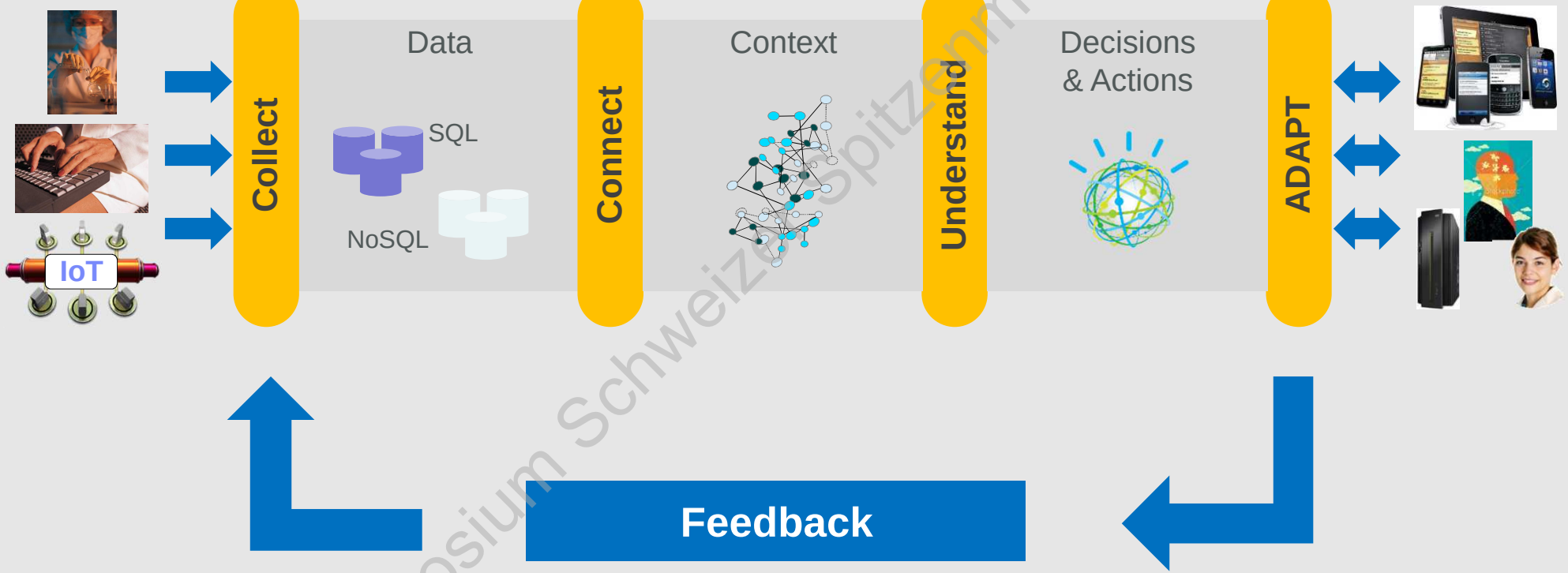
Cognitive decision support



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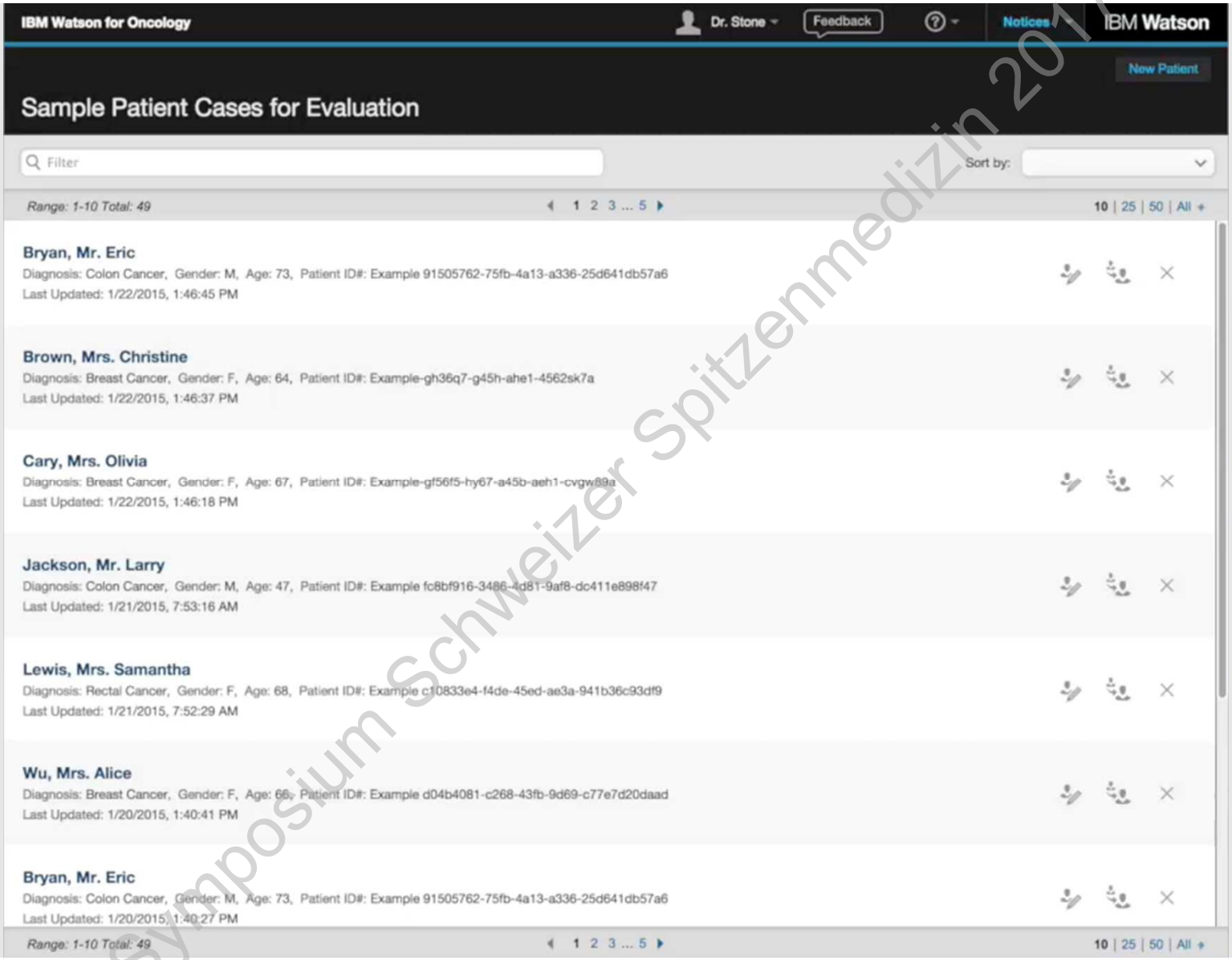

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Medical Sieve

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#CognitiveEra

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Working to transform Parkinson’s disease care

1 in 1,000
expected to develop Parkinson’s

10%
are under 50 years of age

$25 billion
in annual direct and indirect costs of care, social payments and lost income

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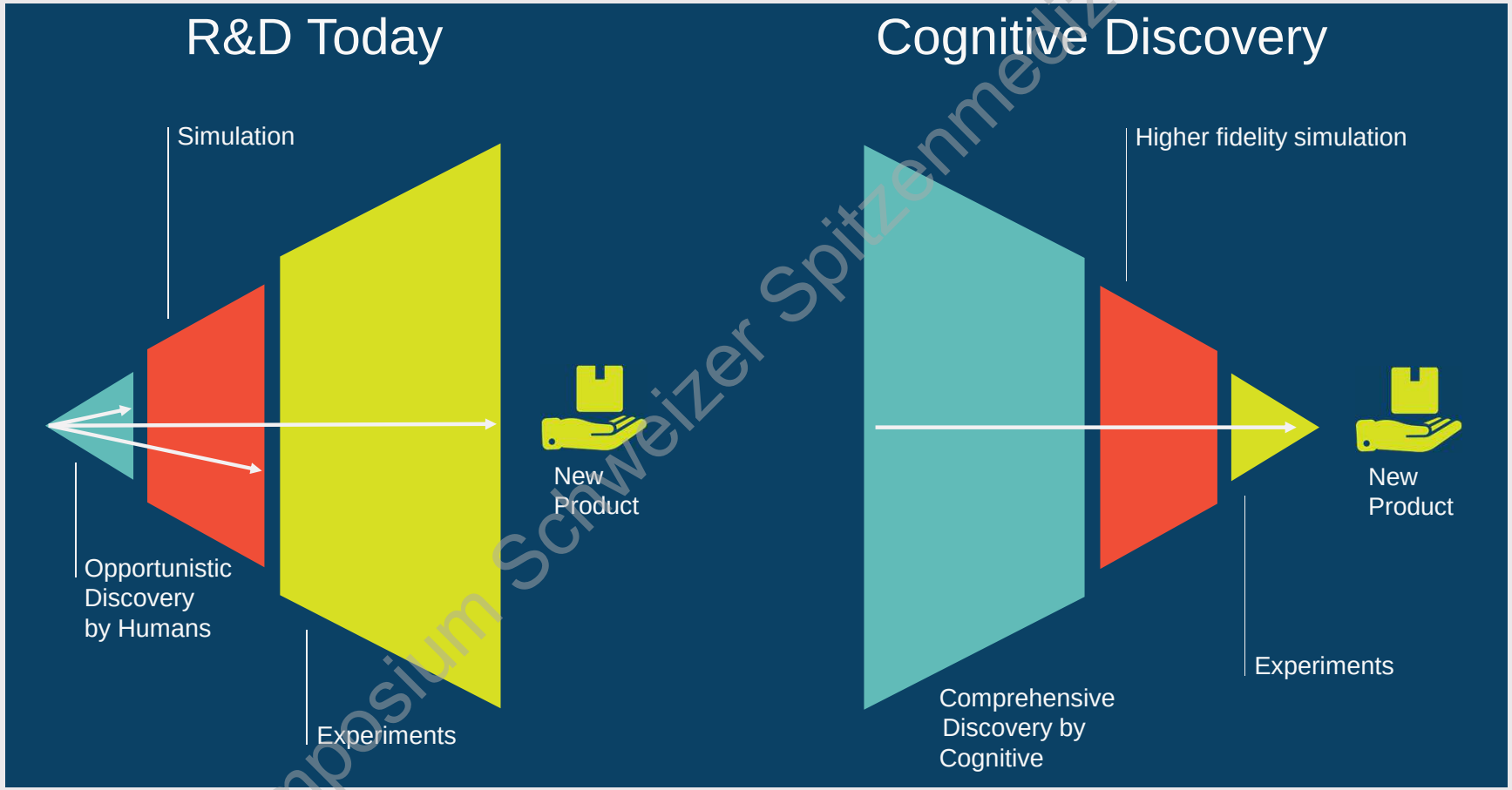
Research Assistant



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The amount of medical knowledge continues to explode to the point where it will double every 73 days by the year 2020

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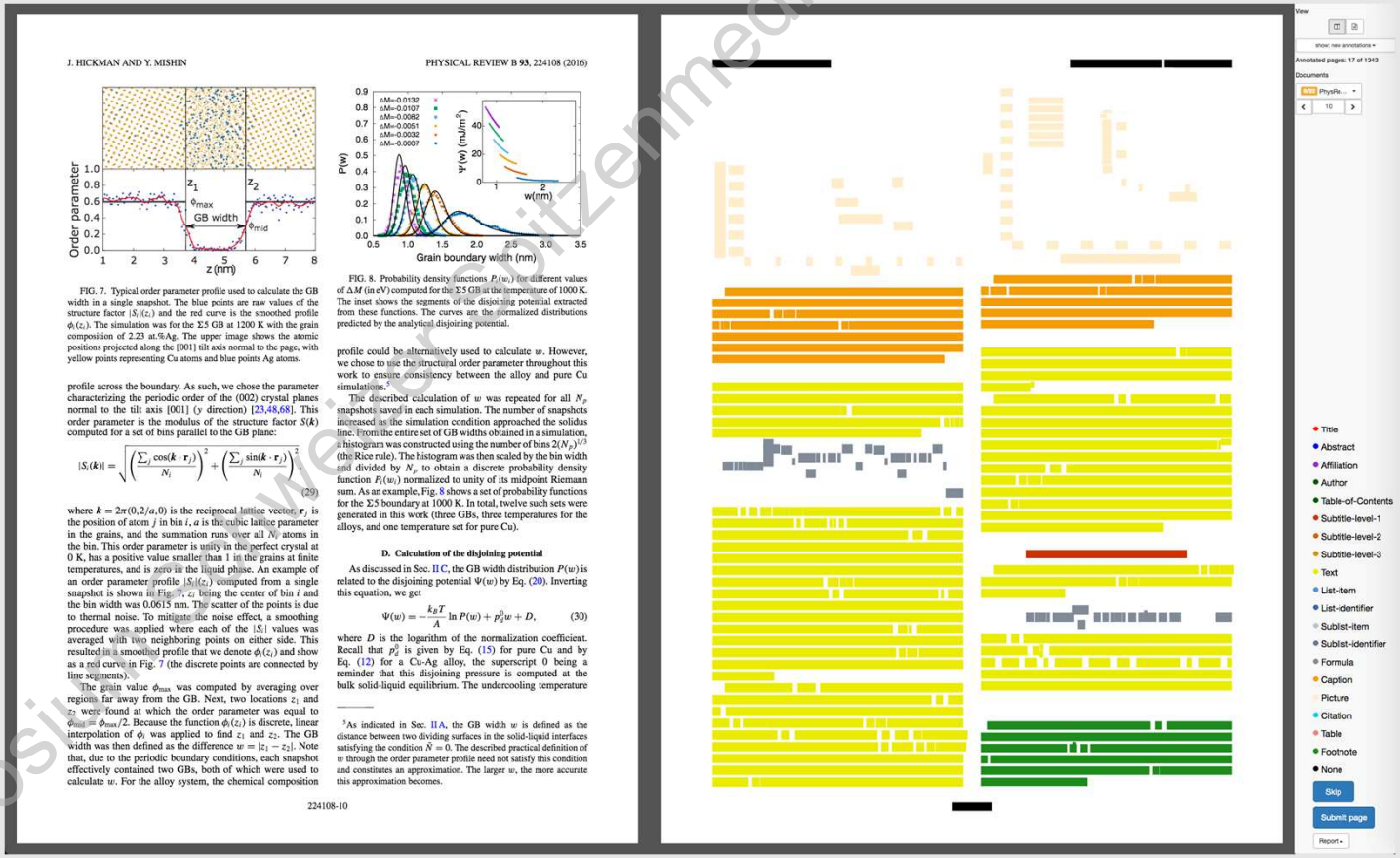
Deep parsing of scientific papers
Takes about 30 seconds on a laptop, 20,000 papers/week

Goal:

- Manage
- Parse
- Annotate
- Train/learn
- Convert

PDF documents into a semantic representation



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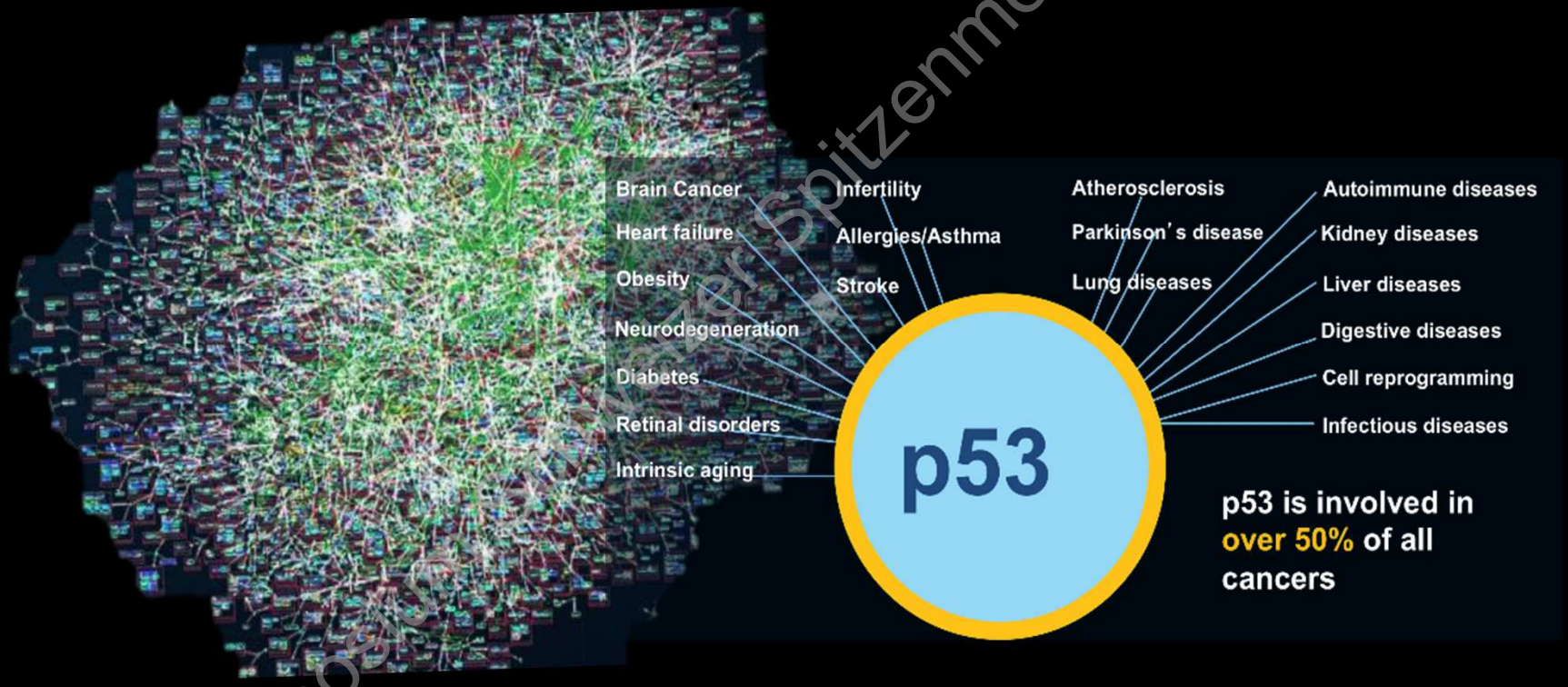
Cognitive Discovery



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Implications for academic education and professional development in medicine

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Implications can be identified on various levels

- Leveraging AI for personalized learning and teaching
- Training how to work with the AI system (e.g. when to trust an algorithm and when to trust the own intuition, asking the right questions)
- Enhancing human core competencies to optimize partnership of men and machine for the benefit of the patients (Digital humanism)
- Developing methods to cultivate critical thinking
- Developing a new research approach
- …

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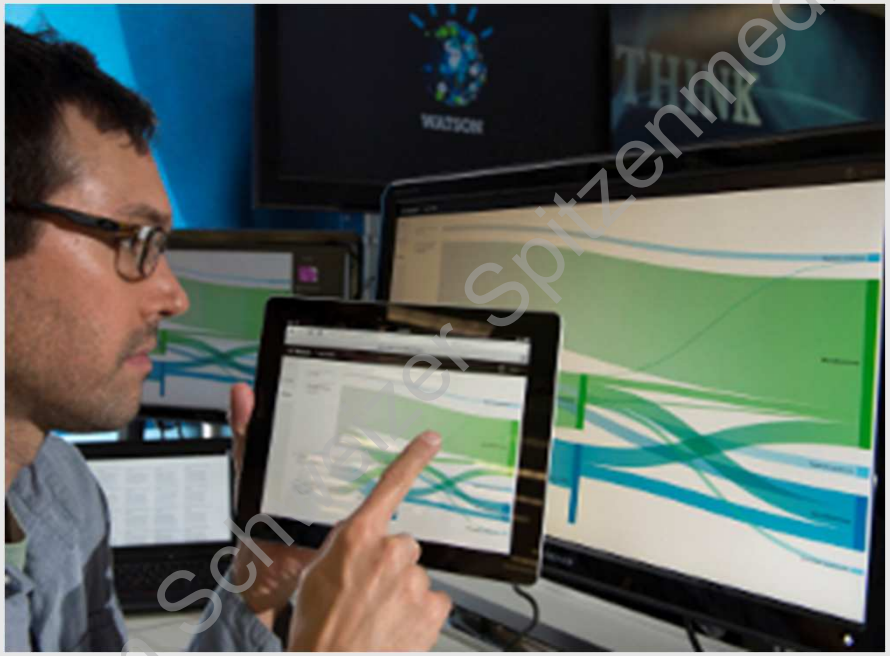
Cognitive Tutor for medical students at Humanitas University



Personalized study platform through the choice of content, simulations, feedback and insights with the level of knowledge of the individual student, through a simple interface as an app.

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Value judgement
Dilemmas
Intuition
Dreaming
Creativity
Design
Empathy
Holistic perception
Generalization
Abstraction
Common sense
Critical thinking

Deep learning
Pattern discovery
Statistical reasoning
Large-scale math
Locating Knowledge
Fact checking
Eliminating bias
Endless capacity
Total recall

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Principles for the Sustainable Development of AI

Purpose
Augment human intelligence, rather than replace it

Transparency & Trust
– When and for what purposes is AI being applied?
– Which sources of data and expertise create an insight?
– Prevent Bias and Misuse: AI systems need to be as transparent as possible (data sets, algorithms)
– How to embed values?

Economic Opportunity & Societal Implications
– Skills and knowledge to perform the work that will emerge in a cognitive economy
- Fundamental transformations in the way we live and work
- Legal and governance implications of AI

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outthink limits

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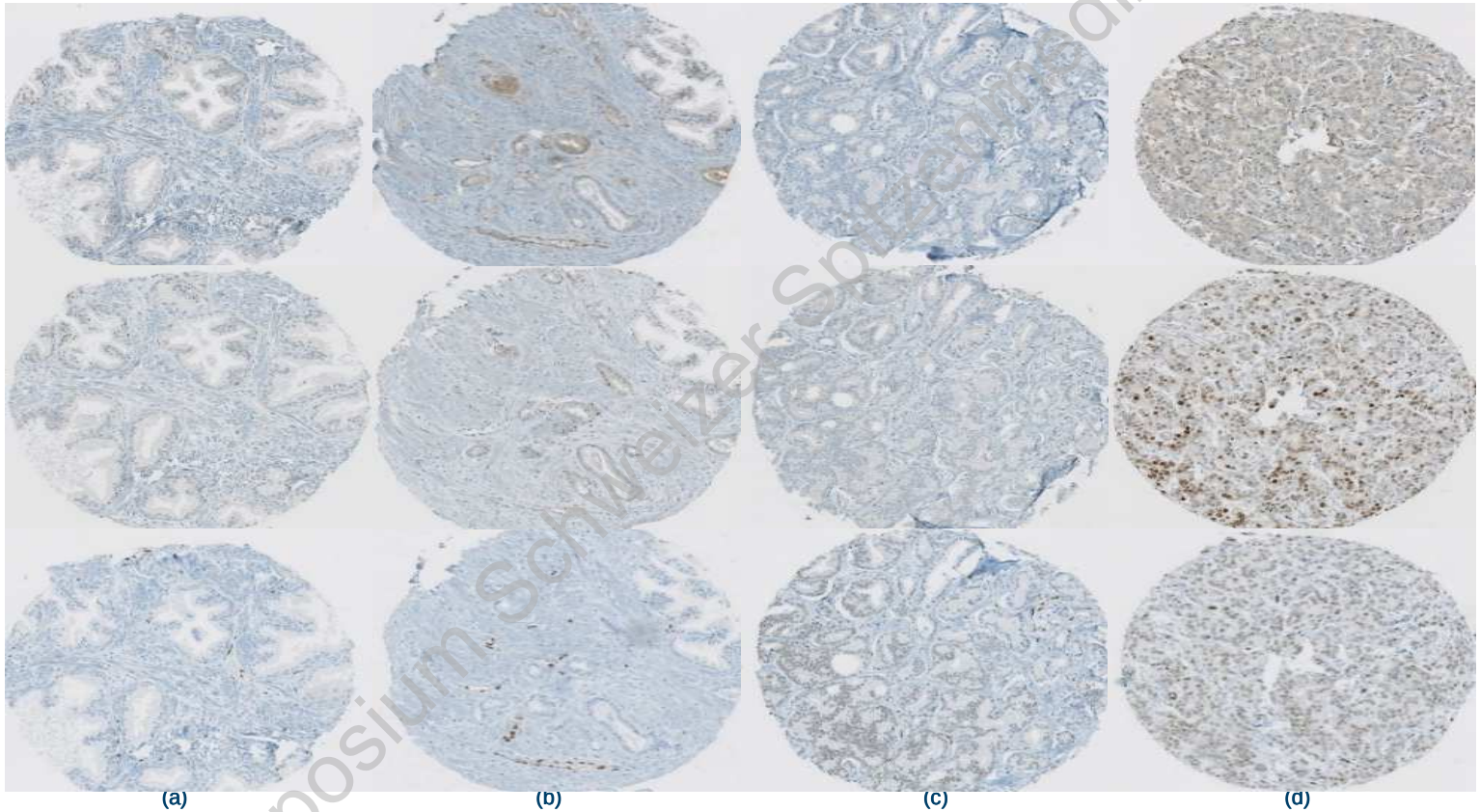
Digital Pathology

PTEN

P53

ERG



IHC prostate images of (a) normal, (b) GS=3+3, (c) GS=3+4/4+3 (d) GS=4+5

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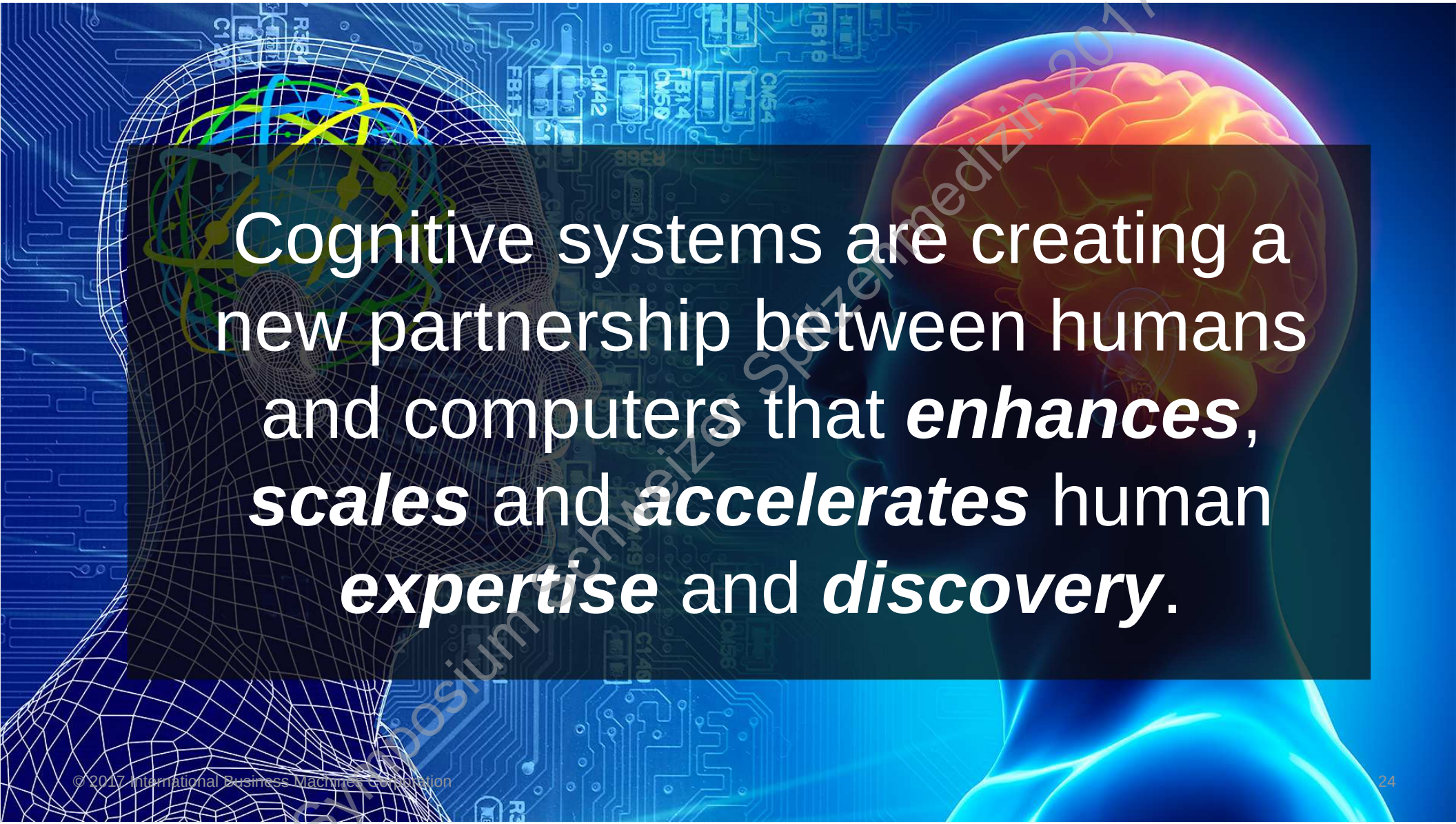
UniversitätsSpital Zürich



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