Artificial Intelligence in Education & Research

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Data & AI Specialist, Microsoft GR/CY/ML
Microsoft’s Vision for a Digital Era

Digital Transformation is an imperative increasingly requiring organizations to offer higher-value experiences.

- Multi-device, Multi-sense
- Artificial Intelligence
- Serverless

Intelligent Cloud

Intelligent Edge
Digital Transformation Customer Outcomes

Microsoft is focused on empowering every individual and every organization to achieve more through Digital Transformation.

Modern workplace
Business applications
Applications & infrastructure
Data & AI

Empower educators
Engage students
Optimize operations
Transform learning
Education Industry Trends and Insights

- Cognitive Services
- Open education movement
- Artificial Intelligence
- Blockchain
- Virtual Reality / Augmented Reality

- Demographic shifts
- Rising student expectations with increased awareness
- Technology adoption esp. mobile
- Aging workforce and understaffed workforce to teach new areas that are popular among students
- The age of hyper individuality

- Technological advances
- Democratization of knowledge
- Digital Technologies
- Global mobility of learning places
- Compete for newer sources of funding

- Environment
- Dispersed, incompatible legacy systems
- Overuse of paper-based procedures
- Siloed & inefficient operations

- Economics & regulatory environment
- Privacy Protection Laws
- Digitalization and eDiscovery
- Data privacy and security
- Ongoing changes in compliance and information standards

Trend Radar
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<td>Equipment Reliability</td>
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Personalized Training for Students

Imagine if we could use AI to personalize learning for each student, follow each student through their journey to process their learning experiences and learning content. We could capture the data from the student journey to provide a tailored approach and take action to optimize their learning experience as they’re progressing.

In this new paradigm, students could learn at their own pace, dynamically collaborate with each other and contribute to each other’s success.

Desired Future State

- PL maps the content to the current ability level (using industry standards), which is tough for institutions
- Help students learn faster, study more efficiently and retain more knowledge
- Link the PL module with LMS to process learning experiences and learning content, structuring that around a student
- Shift the focus from content (currently available as part of various adaptive leaning platforms) to learning environment
- Use AI, Bots, and Machine Learning to link & process the personal, administrative and academic information of a student
- Build the platform on O365 which helps in generating data regarding the download, access and consumption of educational material
- Efficient reporting tools provide a detailed dashboard to instructor and student

Our school is always looking to...

- Improve and sustain school rating
- Improve student’s knowledge & application level
- Prepare students ready for real-world scenarios
- Use digital tools as enabler for holistic betterment of school, students and instructors
Becker gathers specific insights and data on students to develop profiles on each student. Predictive analytics help design personalized learning perspectives, which when applied, help individual students succeed in the best way they can. It empowers educators to understand the variety of challenges students might face and design flexible curriculums that fill those gaps with personalized learning pathways.

**Agile Mindset with Students**

- Discourse Analytics
- **DEVELOP PROFILES**
- **PREDICT PERSONALIZED LEARNING**
- Agile University (building)
- **AZURE ML AND COGNITIVE SERVICES**
- **PREDICT APTITUDE, FIT, ACUMEN**
- **PREPARE FOR SUSTAINABLE CAREERS**
Business school builds an intelligent platform to help people achieve their continuous learning goals

**CHALLENGE**
- Increase brand awareness and appeal to both alumni and prospective students.
- Uncover new revenue streams.
- Use data gathered through AI and machine learning to help users find the right learning paths.
- Bring users a uniquely customized experience.

**SOLUTION**
- Build an intelligent platform to deliver assessment and personalized continuous learning recommendations to users.
- Use Azure, machine learning, and AI to compile data and offer users a personalized feed of recommended content.
- Enable more data creation to target students better.

**BENEFITS**
- Users get more value from their continuous education and professional growth.
- Increased user satisfaction and brand awareness.
- Identify professional gaps for users to offer more curated learning paths.
- School is positioned to disrupt and influence the landscape of online education.
Microsoft Azure also supports other Big Data services like Azure IoT Hub, Azure Event Hubs, Azure Machine Learning and Azure Data Lake to allow customers to tailor the above architecture to meet their unique needs.
Imagine if educators were freed from the routine task of record-keeping and marking. Assisted by an intelligent assistant that grades assessments and provides insights on where students need additional support, the educator spends more time adjusting his lessons and methodology to where his or her students need reinforcement and tailors his or her teaching methodology accordingly. The student owns their learning journey and the educator structures and supports them to achieve their individual goals and developmental needs.

Desired Future State

- An online assignment portal helps the educators in conducting tests and examinations with the use of technology
- The application automatically evaluates all the assignments and throws analytics which represent the student data in various facets – difficult topics for a student, difficult topics for majority of students, highest score, lowest score, median score, questions which took longest time to solve, students who were the quickest in solving correctly etc
- The application is also able to create heterogenous groups of students who lie at different spectrums so that SIG/Focus groups get formed which helps the students in co-learning and taking the understanding and application of topics learnt to an expert level.

We are always looking to...
- Improve and sustain school rating
- Increase student understanding and retention
- More teaching, less managing
- Efficient use of teacher’s time in solving students’ problems
Detecting Plagiarism with AI in K12 and higher Education

With Azure Cognitive services, Unicheck leverages pretrained AI to provide plagiarism check for online submitted thesis and other dissertations, integrating with Moodle and other popular e-learning and course management systems. Search for similarities runs against internet resources and internal data sources.

Serving more than 1,300,000 students and 10,000 educators from over 1,100 institutions in 69 countries worldwide.
Imagine if you could precisely address the educational goals of each student, providing course & career guidance based on aptitudes, interest and market demand; offering education in-person or remotely; and providing prospective employers with an accurate understanding of the student’s education, credentials, and accomplishments.

Desired Future State

- Find the best career path by connecting with academia and business
- Students can earn degrees while studying remotely – without the need to attend universities physically and testing them using tools which mimic the behavior of a professor while evaluating concepts
- Provide digital credentials wallet – certified by taking courses of people who are experts in their field
- Authentication and verification of certificates/credentials is more streamlined and trustworthy

We are always looking to...

- Provide students the choice of studying the courses they wish to study, while meeting specific demands for academic progress
- Ensure the students are evaluated holistically – without any preconceived notions and the process is transparent and open to audit
- Ensure students are able to justify their credentials obtained from our university
- Ensure students today are able to connect to recruiters better and we are willing to connect the students to the recruiters, so that students see the value of our courses and their relevance
Cleveland Metropolitan School District identified early predictors of student performance

“We are using Power BI and Azure Machine Learning to transform education in Cleveland. When we can predict where kids will need help and where they’ll succeed, we can allocate resources where and when we need them.”
—Blessing Nwaozuzu, Executive Director for Enterprise Cleveland Metropolitan School District

“When we can focus on early identification and intervention, it’s much more effective and less expensive than remediation.”
—Rod Houpe, CIO Cleveland Metropolitan School District
With Azure Machine Learning...our educators will be able to...start tackling the problem of student disengagement.

—Shaun Taylor, CIO, Tacoma Public Schools

Tacoma Public schools increased graduation rates from 55% to 82.6%

Identify key factors that influence student outcomes

Improve student academic performance

Provide timely intervention and corrective action to at-risk students
Carnegie Mellon Sees a Way to Cut Energy Use by 20% with Cloud Machine Learning Solution

PI system from ISV partner OSIsoft, in combination with Azure Machine Learning to:

- Reduce energy costs by 20%
- Predict future waste and equipment failure

“We immediately began using Azure Machine Learning without having to prepare on-premises software; everything’s ready-to-use in the cloud.”

Bertrand Lasternas
CMU Researcher
### Challenge

Optimizing energy efficiency and management was a challenge when managing multiple facilities. The data was collected separately from each system for analysis, a time-consuming process that produced limited insight into system performance.

University wanted a centralized, integrated infrastructure with dynamic, custom reporting tools and access to real-time data and events.

### Strategy

The University implemented the system that integrated all of the building automation systems as well as lights, ventilation, air quality, weather, and security data sources.

The system provides insight into performance through a real-time energy dashboard. Data is collected from facilities and analyzed using cloud services to transform data into insights, rich visualizations, and reports.

### Results

- More accessible data at all levels
- 30 percent less energy consumption
- Reduced IT costs
- Building’s information available from virtually anywhere in the world
- New opportunities to improve energy efficiency
Provide courses for deaf and hard-hearing students

While teachers are speaking, their voice presents as text and in different languages so that deaf people can as well participate. Courses are also recorded for later use.

• Azure Cognitive Services:
  ✓ SPEECH TO TEXT
  ✓ TRANSLATOR
Research Computing and Computing for Research
The Changing Nature of Research

Experimental  Theoretical  Computational  Data Intensive
It took 13 years to sequence the first human genome, but we can now sequence a human genome in a matter of hours. And it is in the worlds of science and research that we are experiencing the significant social and economic impacts of big data, in all aspects of life.

Tony Hey, Chief Data Scientist, Science & Technology Facilities Council
Volume and Velocity of Data is Increasing

Human Genome Project
750MB Storage

Large Hadron Collider
700MB/Second | 15PB/Year

Square Kilometer Array
60GB/Second | 1M PB/Year

1990

2020
54
Azure regions
More than AWS & Google combined
Inside the Data Center

Entry Level VMs
Dev/Test Workloads

General Purpose VMs
Common Applications, Web servers etc

Compute Optimized VMs
Gaming, Analytics

Large Memory VMs
Large Databases

Low latency, high throughput apps

Storage optimized VMs
No SQL Databases (Cassandra, MongoDB), Data warehousing

High Performance VMs
Batch processing, fluid dynamics, monte carlo simulation

GPU-enabled VMs
NV - Graphic based applications
NC2 – Advanced Sim (P100-X)
ND1 – AI Inferencing (P40)
ND2* – AI Training (V100/V100 SXM)

FPGA*
Virtual Machines – HPC FPGA Microservices – AI/Edge

Cray Services in Azure
IB Connected CPU/GPU/Storage available in cloud
HPC VMs on Azure
No-compromise CPU and GPU based resources

H-Series:
Most powerful CPU virtual machines with optional RDMA

- Up to 16 cores, 3.2 GHz E5-2667 V3 Haswell processor
- Up to 224 GB DDR4 memory, 14GB per core
- FDR InfiniBand @ 56 Gbps, 2.6 microsecond latency
- 2 TB of local SSD

H-Series:
- Up to 44 cores, Intel Xeon Platinum processor
- Up to 352 GB DDR4 memory, 8GB per core
- EDR InfiniBand @ 100 Gbps
- 700 GB NVMe

H-Series:
- Up to 60 cores, AMD EPYC processor
- Up to 240 GB DDR4 memory, 4GB per core
- EDR InfiniBand @ 100 Gbps
- 700 GB NVMe

N-Series:
GPU virtual machines specialized for graphic-intensive workloads

N-Series:
- Up to 4 NVIDIA Tesla K80 GPUs
- Up to 24 cores
- Up to 224 GiB memory
- Up to 1440 GiB of local SSD
- FDR InfiniBand

N-Series:
- Up to 4 NVIDIA Pascal P100 GPUs
- Up to 24 cores
- Up to 448 GiB memory
- Up to 3 TB of local SSD
- FDR InfiniBand

N-Series:
- Up to 4 NVIDIA Volta V100 GPUs
- Up to 24 cores
- Up to 448 GiB memory
- Up to 3 TB of local SSD
- FDR InfiniBand

N-Series:
- Up to 4 NVIDIA Pascal P40 GPUs
- Up to 24 cores
- Up to 448 GiB memory
- Up to 3 TB of local SSD
- FDR InfiniBand

N-Series:
- Up to 4 NVIDIA Tesla M60 GPUs
- Up to 24 cores
- Up to 448 GiB memory
- Up to 2,948 GiB of local SSD

N-Series:
- Up to 4 NVIDIA Tesla M60 GPUs
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Digitization of Sensors is Expanding
Complexity of Data is Growing
Machine Learning and AI Advances are Accelerating

Microsoft's AI is getting crazily good at speech recognition

Microsoft's speech recognition efforts have hit a significant milestone.

It can now transcribe human speech with a 5.4% error rate, Microsoft
Cloud Computing as an Emerging, Enabling Platform for Research

**Omnipresent Services**
- Data Services
- Compute Services
- Machine Learning Services
- Networking Services
- Redundancy
- Security

**Collaboration Accelerant**
- Sharing data
- Sharing algorithms
- Co-authoring
- Reproducible Research
- Geographical accessibility

**Compute & Storage Elasticity**
- Platform flexibility
- On-demand scaling
- Standardized interfaces
- Low overheads
- Lower barriers to adoption
### Supported applications, solvers, services, platforms, and frameworks

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## Azure: Trusted

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Case Study: Australian National University pioneers the next generation of genomics research by moving to the cloud

- “I estimate over the last three and a half years I’ve probably spent a year on the technical aspects of enabling our research. So, I would say Azure would probably reduce that time by 50 to 75 percent”

- “We were able to access four times the computational power for half the price compared to the on-premises hardware we’d been using previously. With Azure, we can actually limit our expenses by only paying for the time we need”

• The Square Kilometer Array (SKA) is a multi-billion dollar international project to build the world’s largest radio telescope.

• The team provided a highly customized CycleCloud environment that enabled large scale analysis of a first data-set.

• The SKA radars will generate 600 PB of data per years in five years from now.
“We now take the knowledge used in engineering and apply it to operations. By adding Azure Digital Twins and IoT Hub, we gained the ability to collect data from different sources and apply it to simulations through scalable compute in Azure.”

—Sameer Kher, Senior Director, Twin Builder Product Line, Ansys

Situation:
Ansys Twin Builder simulates how product concepts will likely perform in the real world. The company wanted to extend its software's capabilities to existing products, combining physics-based simulations with analytics-driven digital twins.

Solution:
Using Microsoft Azure Digital Twins and Azure IoT Hub, the company blended continuous real-time data gathered from IoT sensors with physics-based modeling and simulation values—producing granular product iteration insights.

Impact:
Ansys has not only opened countless new opportunities and revenue streams, but it's also helped its customers dramatically reduce the time it takes to produce a digital twin, improve product performance, and cut maintenance costs.
Bar Ilan Experiment – Cryptanalysis Research
Global insurance firm models complex natural disasters with cloud-based HPC

AXA Global P&C manages reinsurance programs for the AXA Group, a global insurance provider based in Paris, France. To create complex catastrophe models for floods and other natural disasters, a team of actuaries created a high-performance computing (HPC) solution based on the Microsoft Azure platform and Azure HPC Pack. Now, AXA Group can improve insurance services with more accurate, detailed information about events ranging from floods to hurricanes.
Advancing Scientific Research

Azure technology for high-energy physics computing

Advanced diagnostic imaging solutions at scale

Open-source Big Compute for life sciences

Saving shellfish by predicting ocean chemistry
Azure, Asteroids and AI:
How academics at Leiden University are using Microsoft Azure to transform their research

COVID-19 Research Accelerator Program

Datasets + Azure Compute & Data Scientists
COVID-19 Research Accelerator Program

Datasets

Offering: Azure Open Datasets

Description: A repository of publicly available datasets.

Relevant Available Dataset: COVID-19 Open Research Dataset

Cost of uploading new Datasets: None if under 10TB.

Compute & Data Scientists

Offering: AI For Health COVID-19

Description: Grants for Azure compute and data science resources for nonprofits, governments and academic researchers that are on the front lines of research of COVID-19.

COVID-19 Grant Process: Applications for COVID-19 grants are available here.