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# The Benefits of Mining Techniques in Digital Transformation of Engineering Education

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# The Benefits of Mining Techniques in Digital Transformation of Engineering Education

## Agenda

1. Digital transformation of education
2. Digital transformation in industry. Forth industrial revolution
3. The influence on the engineering education
4. The role of data and data mining
5. The role of process mining
6. Conclusion

# The Benefits of Mining Techniques in Digital Transformation of Engineering Education

## Digital Transformation in Higher Education

The digitally transformed education is interactive and is supported by technologies or practical instructions that help effective use of innovations.

It comprises applying of wide spectrum of practices as mixed and virtual education which are outlined as wide accepted framework of digital education.

The digital transformation of learning environments should be viewed as one component of the institution's larger strategy and vision.

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## Digital Transformation in Higher Education

The digital education strategy of Oxford University begins with the principles that:

- the traditional forms of teaching and learning such as tutorials and small groups teaching should be continued and maximized;
- academic staff should be supported in innovating in teaching methods;
- students should benefit from the increased learning opportunities that digital education offers.

# The Benefits of Mining Techniques in Digital Transformation of Engineering Education

The part of main tasks of the Bulgarian National Program

Keeping and guaranteeing the leading role of teachers in the education system;

Developing blended learning (traditional + e-learning) - at all levels of the education system;

Development of traditional training in an environment equipped with new technologies;

Development of e-learning, mobile and ubiquitous education;

Using innovative educational technologies to attract students from all over the world;

Use of innovative didactic models;

Applying a research approach to education;

# The Benefits of Mining Techniques in Digital Transformation of Engineering Education

## Digitally transformed classroom



# The Benefits of Mining Techniques in Digital Transformation of Engineering Education

## Expected benefits

**For students:** Students will be more actively engaged, have a better learning experience, be better prepared for the careers of the future, and find new, innovative ways to solve problems.

**For teachers:** Teachers will be able to innovate their teaching methods - and make their classes more interesting, engaging and effective.

**For the curriculum:** The curriculum will be more interesting and relevant.

**For the institution:** The adoption of new learning technology will enable innovative solutions that promise to improve learning processes while enhancing the cost effectiveness of campus services.

# The Benefits of Mining Techniques in Digital Transformation of Engineering Education

Fourth industrial revolutions



**Digital Transformation**

-  **1st Industrial Revolution: Water and Steam**
-  **2nd Industrial Revolution: Electric Power**
-  **3rd Industrial Revolution: Electronics**
-  **4th Industrial Revolution: Digital**



# The Benefits of Mining Techniques in Digital Transformation of Engineering Education

## Digital transformation in industry

Today's changes in the industry are the result of the increasing mass penetration of the Internet of Things, robotics, 3D printing, artificial intelligence based technologies, digital manufacturing processes and cloud solutions.

Humans will remain an essential part of the Industry 4.0 world as creative executives who use their intelligence to set up the necessary procedures and create machine management software.

People with their competencies, expertise and adaptability are the future workforce - highly skilled, intelligent and efficient.

# The Benefits of Mining Techniques in Digital Transformation of Engineering Education

## The influence on the engineering education

In future, the focus of industrial engineering will not only lie on interdisciplinary thinking and acting as well as cross-functional process know-how but also on IT skills involving both specialized and more general application knowledge.

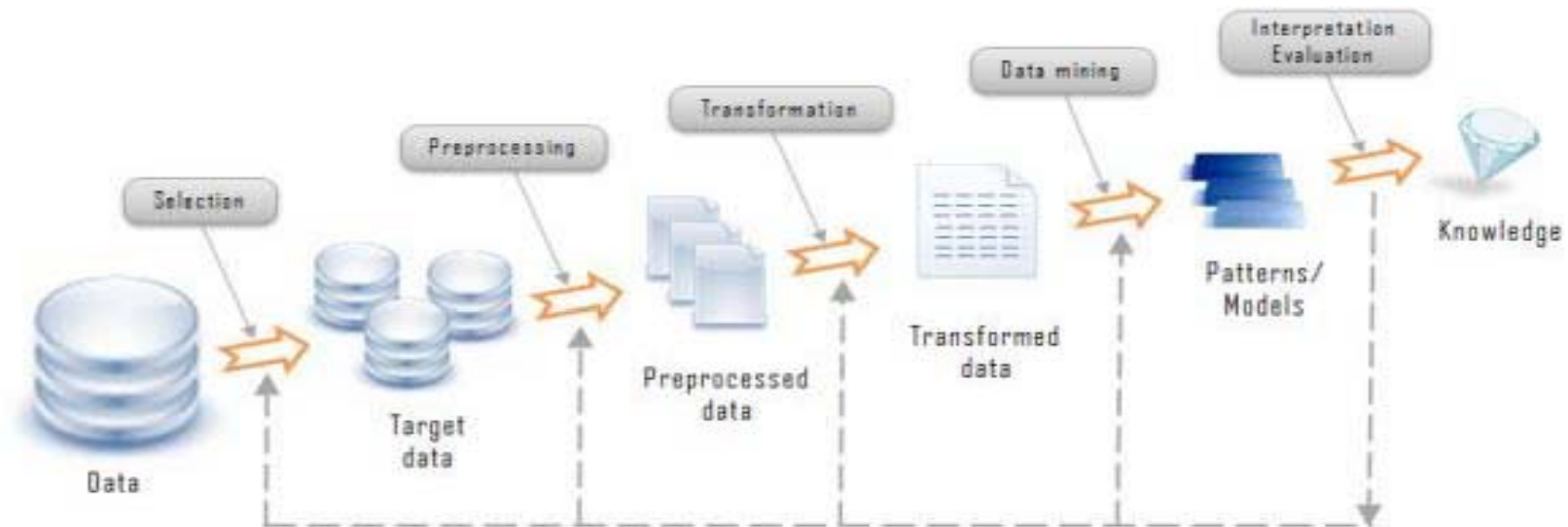
Being a successful worker in Industry 4.0 presents specific questions to qualification needs of this new era of industrial labor.

The innovation and development of cyber-physical systems will require computer scientists and network professionals to work with experts in various disciplines as well as in globalized contexts.

This will revolutionize how universities educate engineers and scientists.

# The Benefits of Mining Techniques in Digital Transformation of Engineering Education

## The role of data and data mining



## The role of data and data mining

Intelligent manufacturing can be defined as a type of information system embedded in physical objects through sensors and actuators in which processes are self-managed, "smart" products initiate corrective actions to prevent defects, and individual components are automatically replaced.

Knowledge of the principles of Big data and Data mining by the future engineers is necessary for their high qualification to adequately respond to the requirements of the digitalized industry.

With this knowledge, they will be able to successfully manage the activities for which they are responsible as:

- Preventive diagnostics;
- Planning and optimizing traffic in transport;
- Remote operational reporting and monitoring of electricity consumed for various purposes;
- Optimizing the generation and consumption of electricity.

## The role of business process modeling and process mining

Process mining is, by definition, limited to the field of extracting useful knowledge from event logs and other similar data sources in the organization.

By extracting an up-to-date process model, it can help validate workflow assumptions as well as identify areas that need improvement.

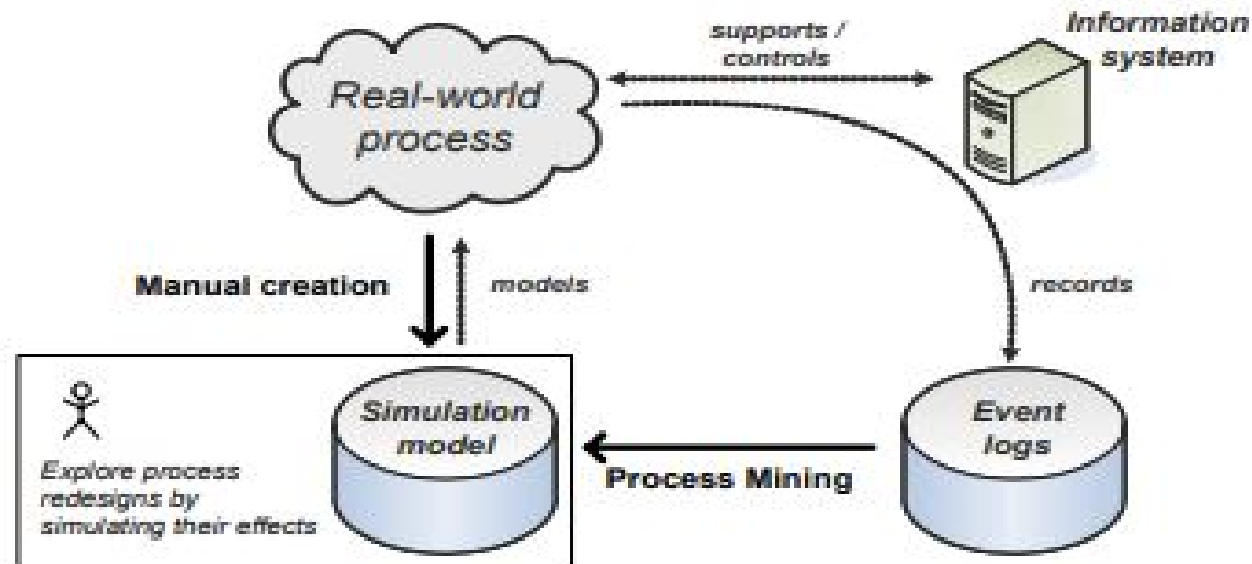
The integration of various mining results to automatically generate a complete simulation model including multiple perspectives is a novel approach and has not been done before.

We focus on the validation aspect as the quality of a simulation model is crucial for drawing conclusions from a simulation run.

The obtained as a result of Process mining business process model is suitable for simulation, as well as helps the engineering professionals to better understand the processes performed in the organizations.

# The Benefits of Mining Techniques in Digital Transformation of Engineering Education

## Process mining procedure



## Conclusions

The digital transformation of training is a necessary step towards preparing professionals qualified to respond to the needs in our reality.

Lack of manpower in manufacturing enterprises and the digitization of the industry necessitate the replacement of humans with machines, robots or software applications in a large number of positions in today's industry.

The main objective is to promote highly qualified engineering personnel who have the knowledge and skills not only in a specific industrial field, but also in information technology, which find application in the respective field.

An important aspect of training future engineers is the ability to work in a team – a team of humans and robots, as well as a multidisciplinary team of professionals.



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# Thank you for attention!

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