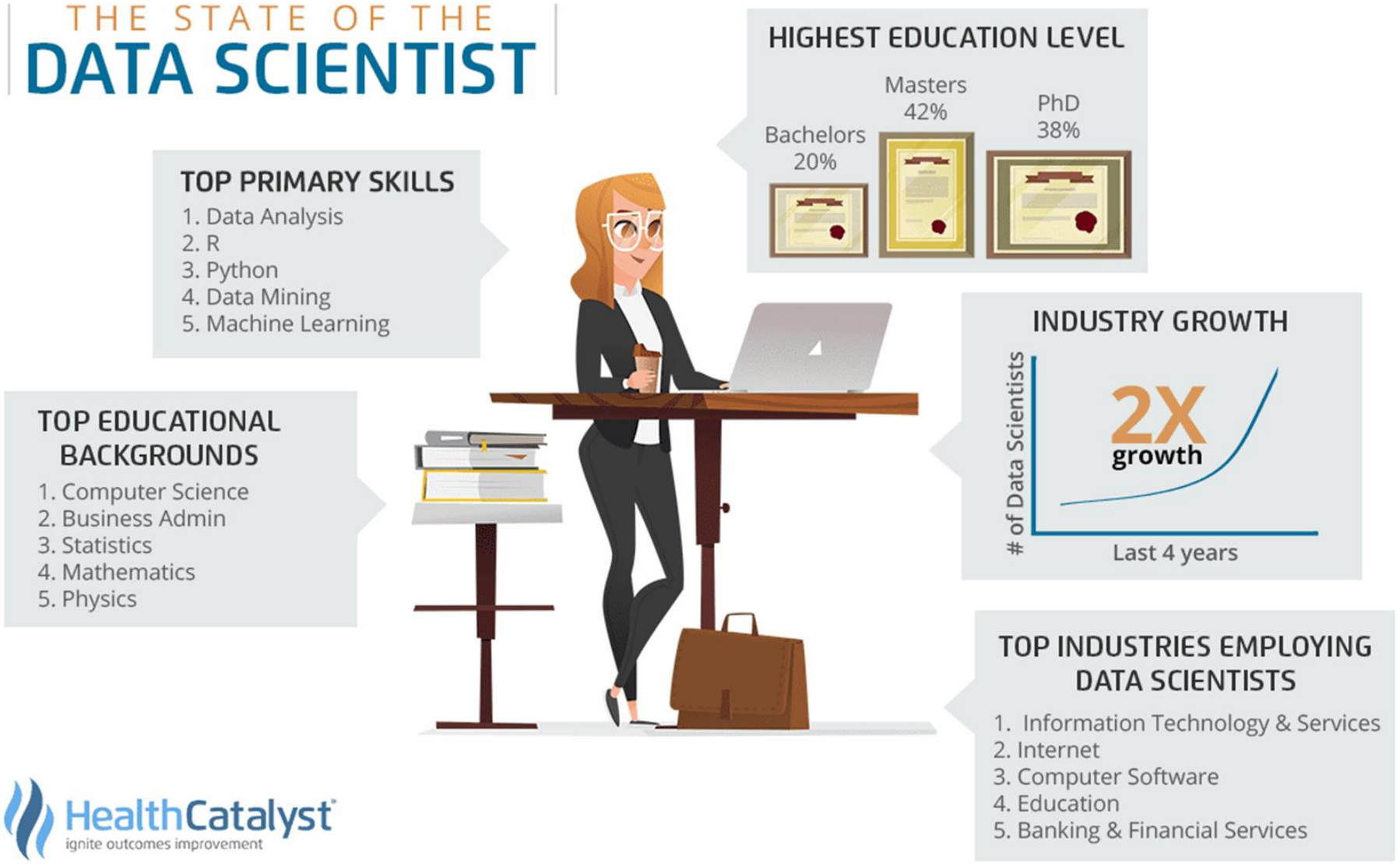
National Research
Tomsk
State
University

TOMSK-1878

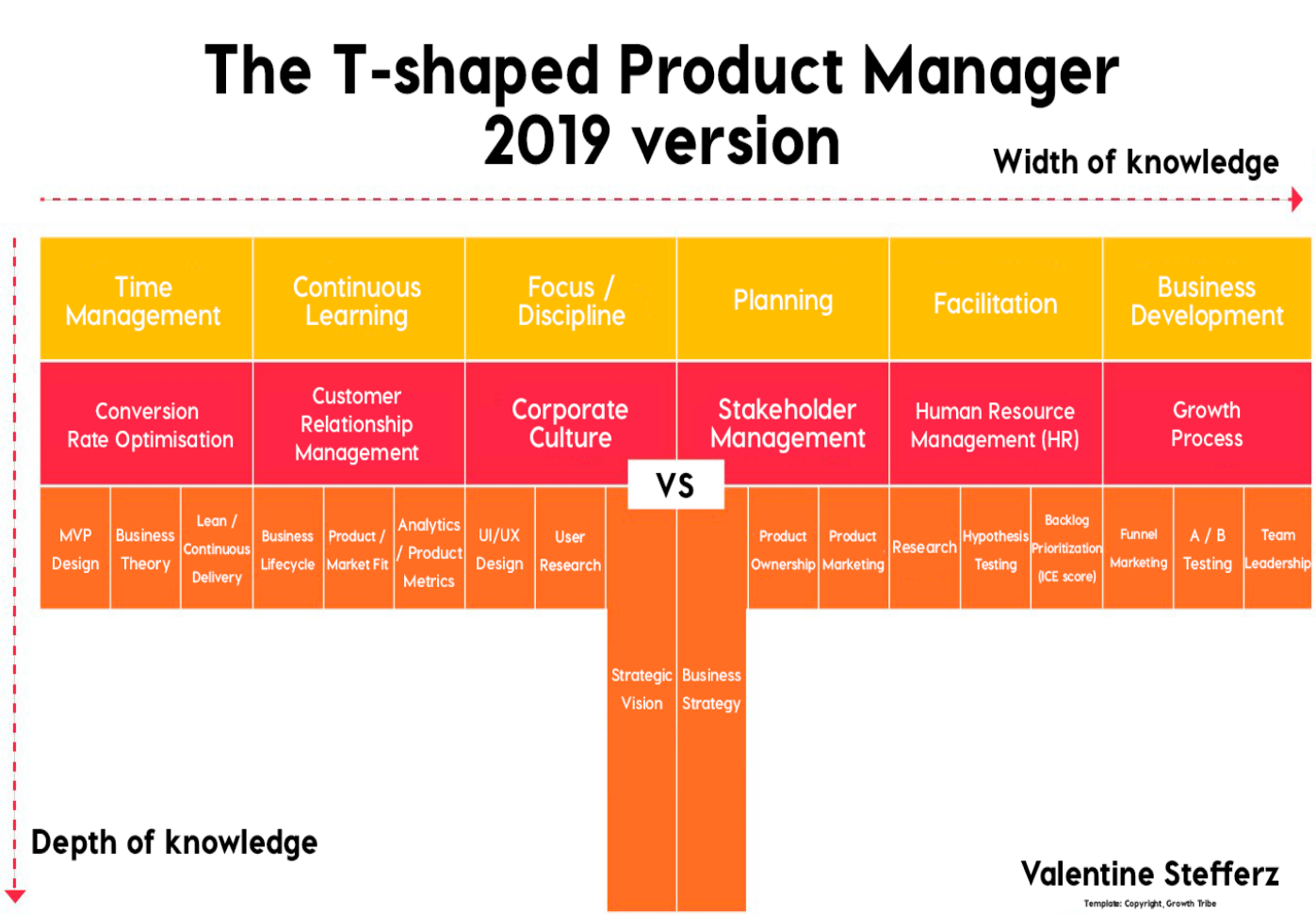
Artificial Intelligence in Education, Research and Development: TSU case-study

A. V. Zamyatin

WHAT SKILLS ARE NECESSARY SKILL IN THE ART AI AND ML: PORTRAIT OF A SPECIALIST?



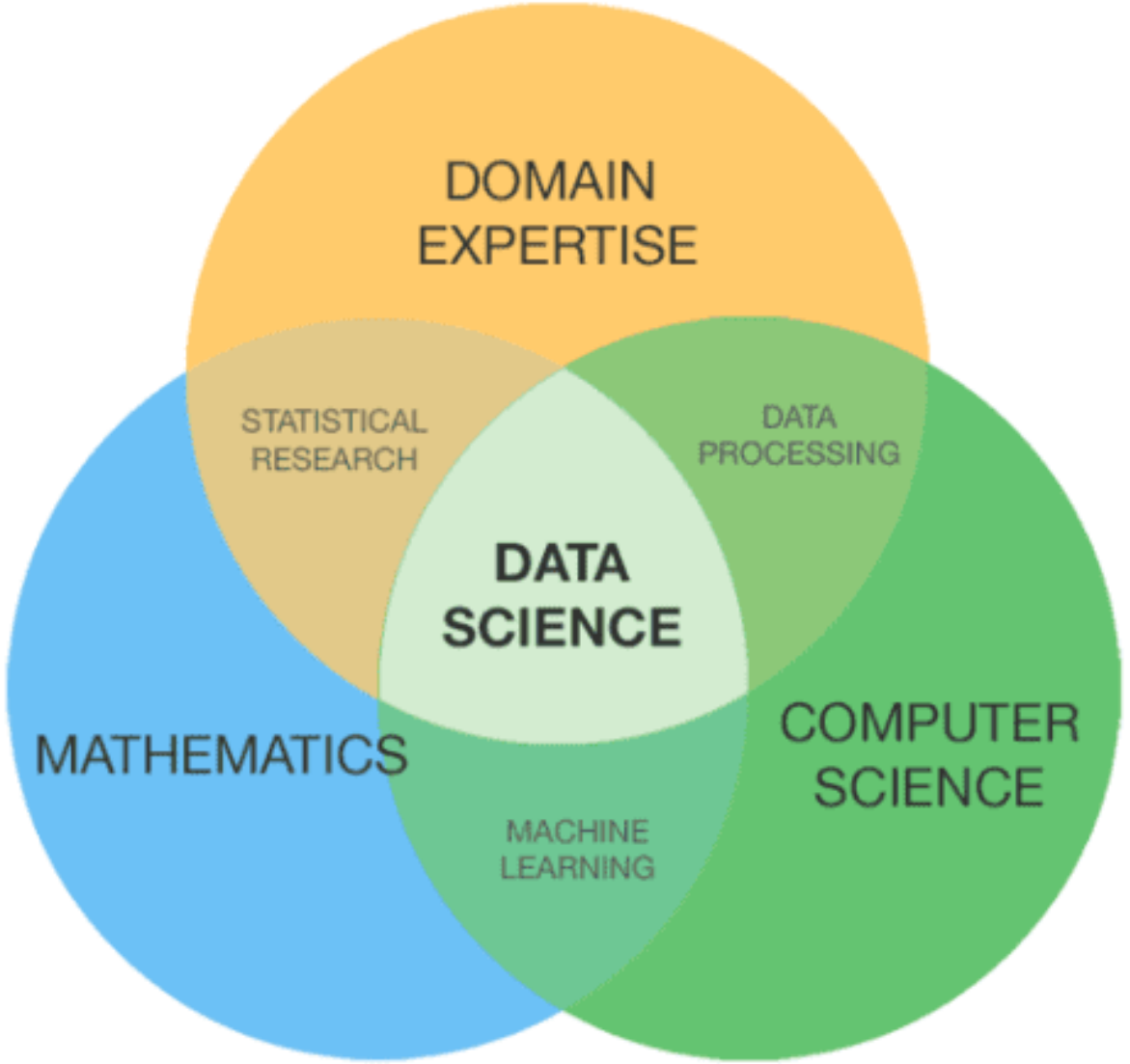
THE MOST POPULAR DIGITAL EXPERTS

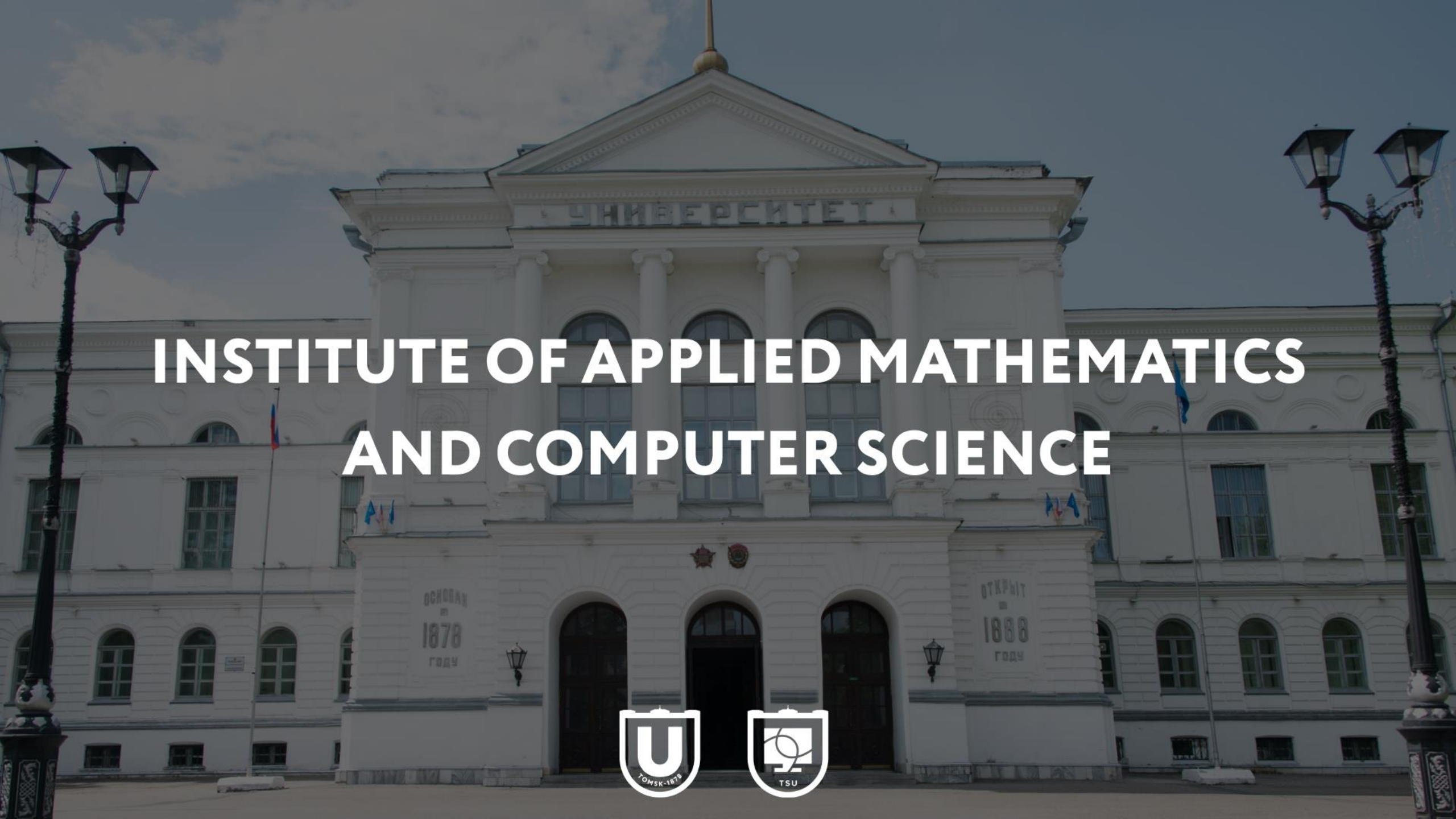


- Product owner or Product manager
- Data scientist, Data engineer, Data analyst
- Java, IOS, and Android Developers
- UI / UX designers
- System analysts, blockchain experts, system architects

According to superjob.ru

WHAT SKILLS ARE NECESSARY SKILL IN THE ART AI AND ML: PORTRAIT OF A SPECIALIST?





INSTITUTE OF APPLIED MATHEMATICS AND COMPUTER SCIENCE

ABOUT THE INSTITUTE

- Opened on **10.07.2017**
- **114** university lecturers, **55** senior lecturer and **31** full professor
- **750** undergraduate and specialist students, **115** master's degree student and **70** PG student

MASTER'S DEGREE PROGRAMS

01.04.02 - Applied Mathematics and Computer Science:

Big Data & Data Science
Information Security
Data Processing, Management and Research of Stochastic Systems

02.04.02 — Fundamental Computer Science and Information Technology:

Immersive Technologies, Technical Vision and Video Analytics
Software Development in Industry 4.0

09.04.03 — Applied Computer Science:

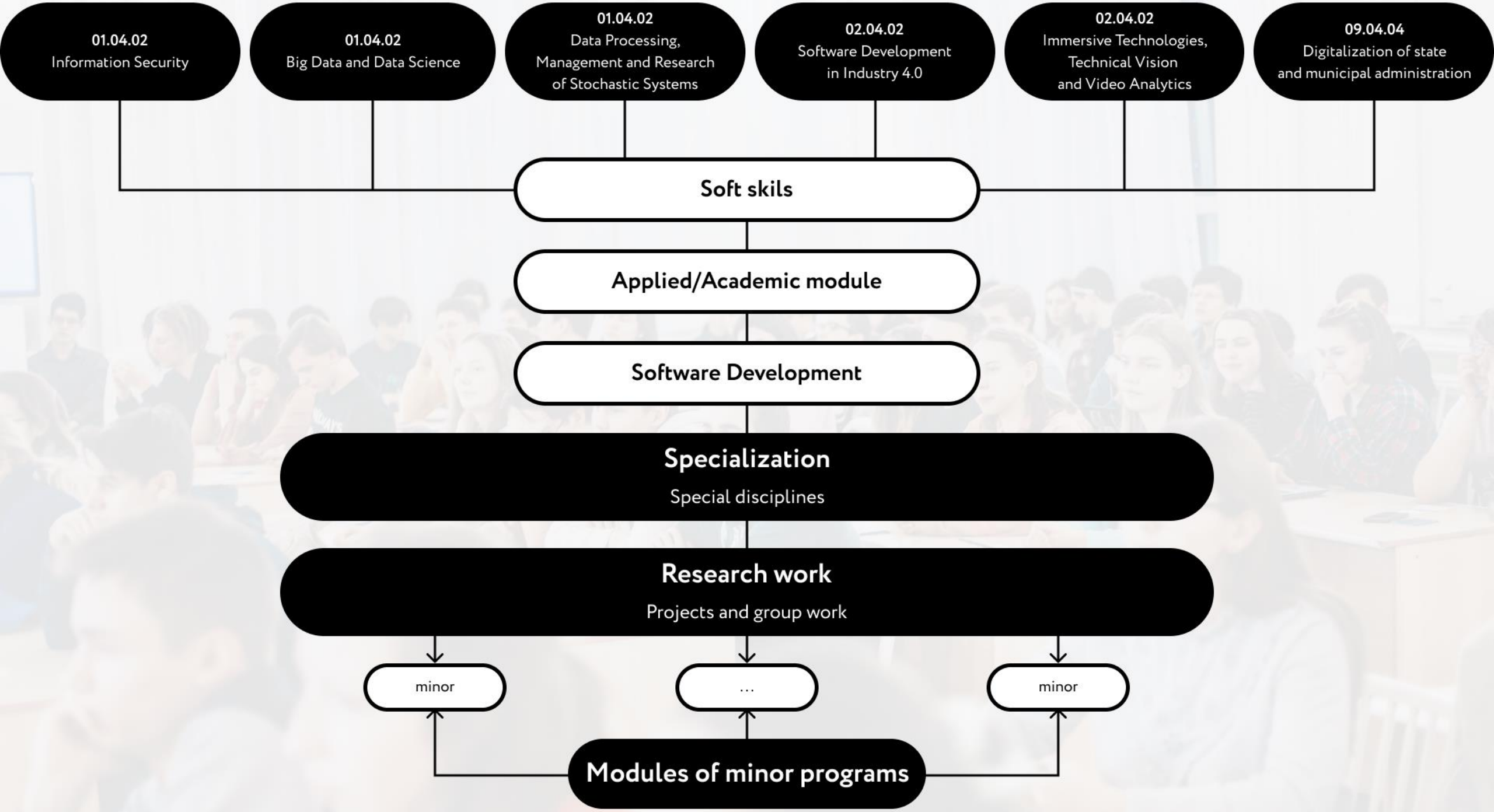
Digitalization of State and Municipal Management / Financial Information Technologies

ENTRANCE TEST

INTERVIEW

99

state-funded place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01.04.02
Data Processing, Management and Research of Stochastic Systems
02.04.02
Software Development in Industry 4.0
02.04.02
Immersive Technologies, Technical Vision and Video Analytics
09.04.04
Digitalization of state and municipal administration
Soft skils
Applied/Academic module
Software Development
Specialization
Special disciplines
Research work
Projects and group work
minor
...
minor
Modules of minor programs

BACHELOR'S DEGREE PROGRAM

- **Applied Mathematics and Computer Science**
  Mathematical Methods in Economics

  01.03.02 – Applied Mathematics and Computer Science

- **Artificial Intelligence and Software Development**

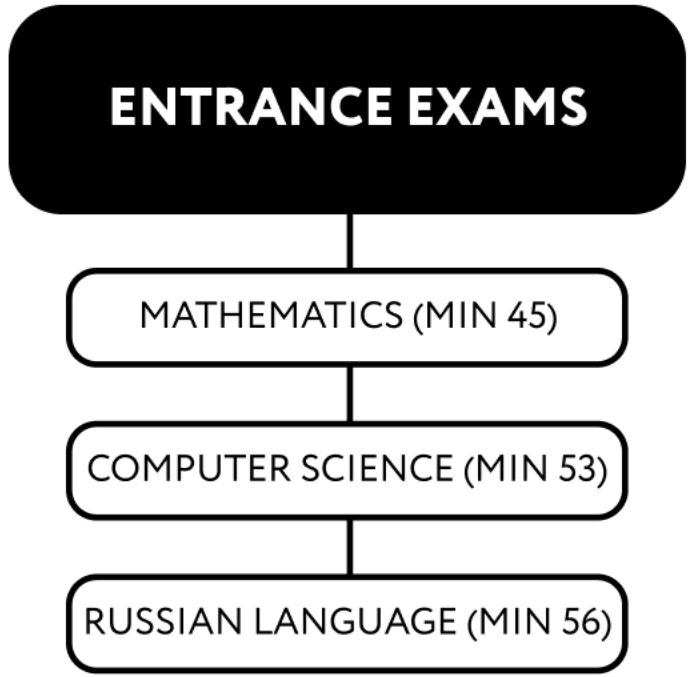
  02.03.02 – Fundamental Computer Science and Information Technology

- **DevOps-engineering in the Administration of the IT Development Infrastructure**

  02.03.03 – Mathematical Support and Administration of Information Systems

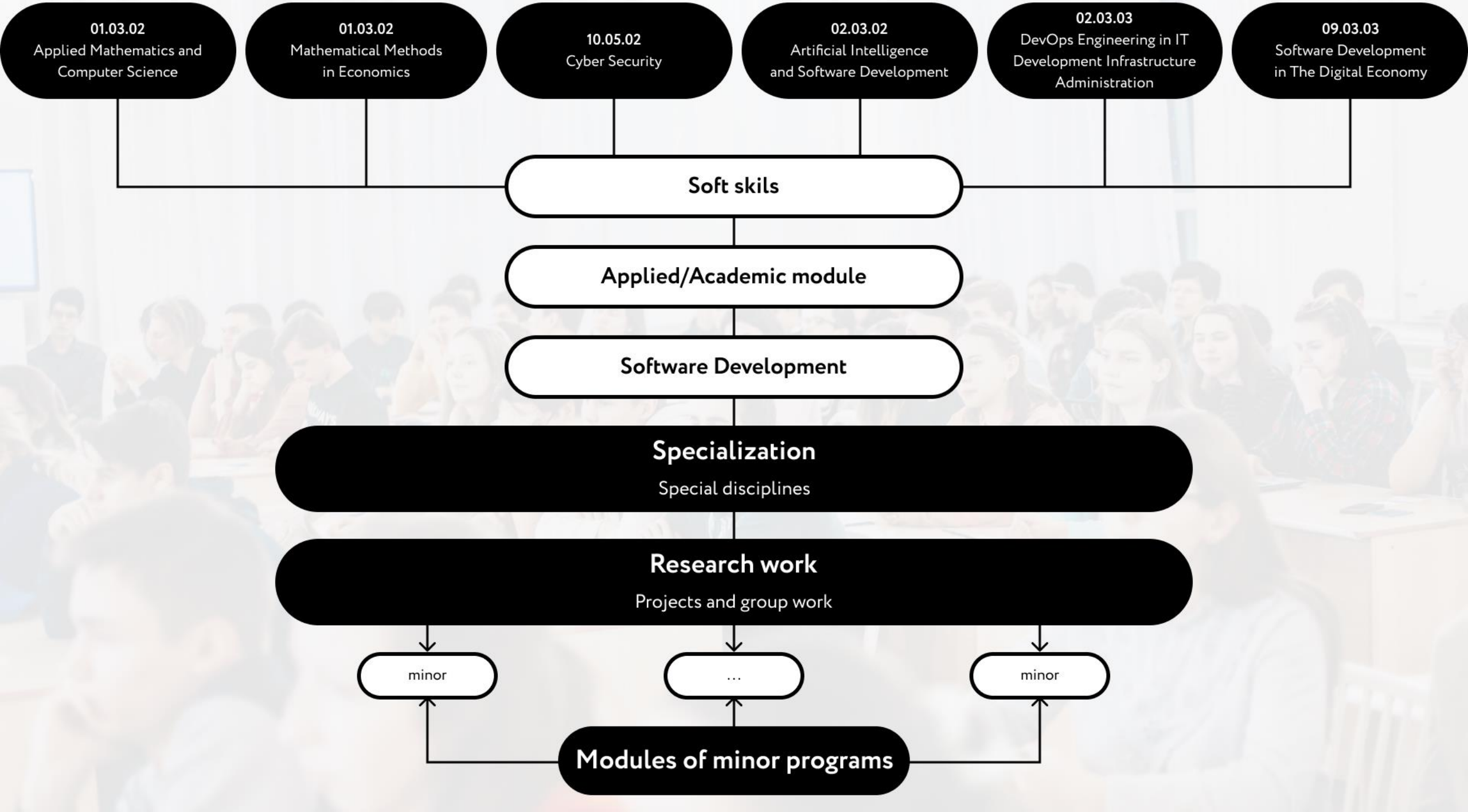
- **Software Development in The Digital Economy**

  09.03.03 – Applied Computer Science



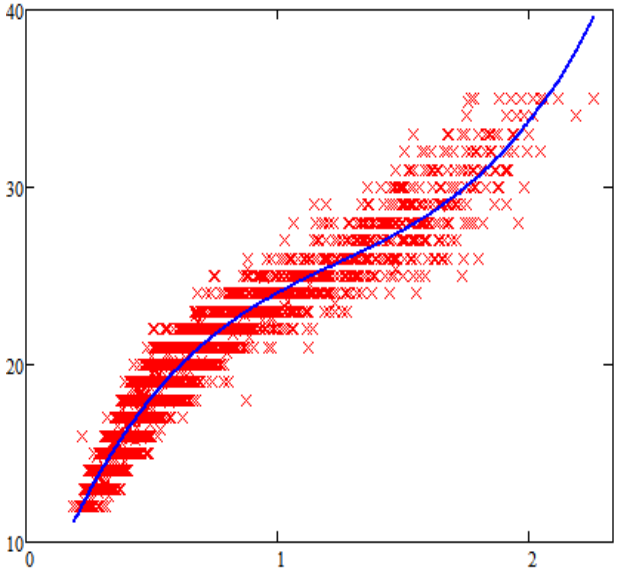
182
state-funded place

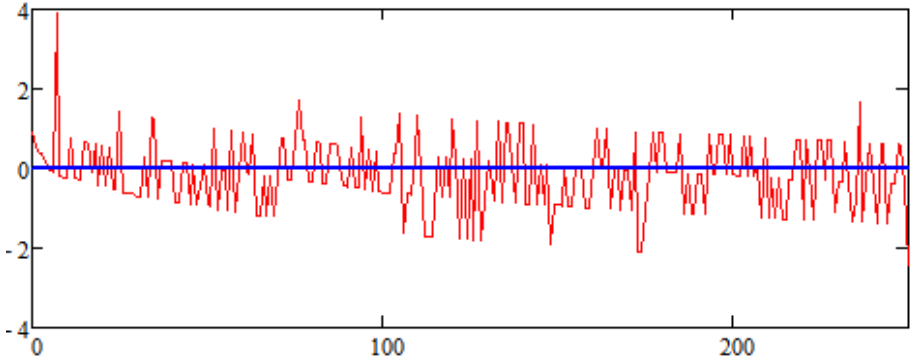
214 -241
passing score 2020


01.03.02
Applied Mathematics and Computer Science
01.03.02
Mathematical Methods in Economics
10.05.02
Cyber Security
02.03.02
Artificial Intelligence and Software Development
02.03.03
DevOps Engineering in IT Development Infrastructure Administration
09.03.03
Software Development in The Digital Economy
Soft skils
Applied/Academic module
Software Development
Specialization
Special disciplines
Research work
Projects and group work
minor
...
minor
Modules of minor programs

RESEARCH: Regression models based on data in cardiology

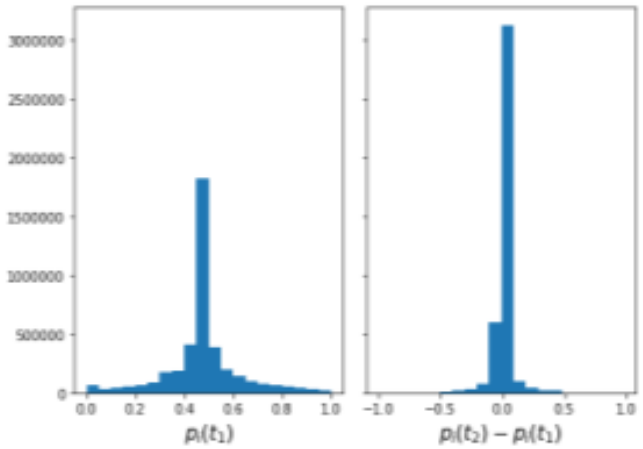
The known dependences of medical indicators in the field of cardiology lead to significant errors in predicting the size of the heart and are significant only with the average physique of the patient; therefore, it is relevant to develop mathematical models with an interval forecast that allow to qualitatively describe the complex functional data structure and determine the medical norm.



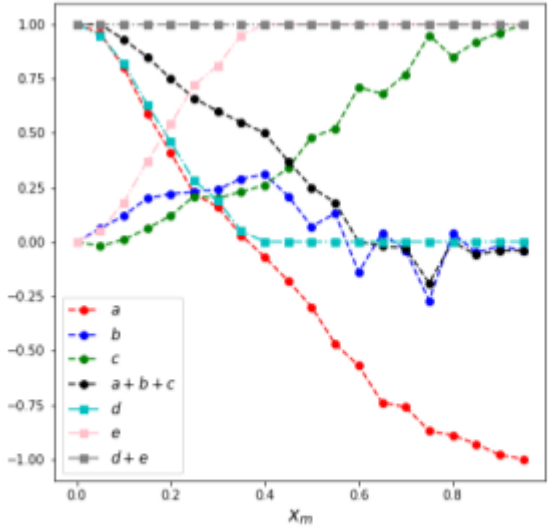


RESEARCH: Social media

We evaluate to what extent this mechanism can describe the real data. Combining machine learning and social network analysis approaches, we retrieve a time series of VKontakte users' opinions as well as information about friendship network connecting them. We state that this mechanism can approach the data a little worse than the best hyper-plane formed by a linear regression model

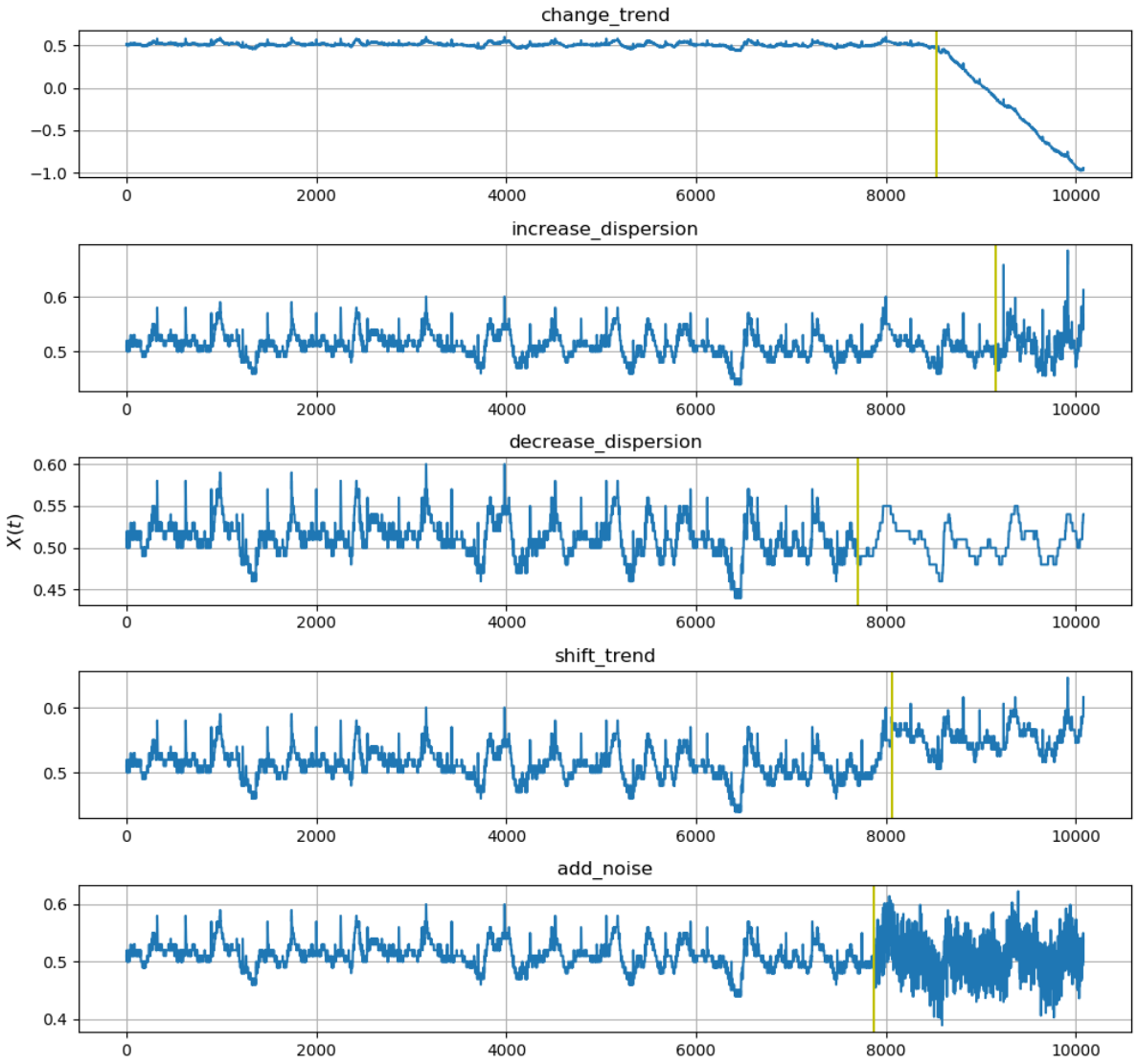


Distributions of users' opinions in February 2018 (left). Distributions of changes of users' opinions from July to February (right).



Coefficients of fitted regression models as functions of threshold x_m.

RESEARCH: AUGMENTED DATA & ANOMALY PATTERNS



Signals augmented with anomalies

Trend change (e.g. performance decline of pump)

$$signal[i] = signal[i] + \alpha * i.$$

Increase dispersion (e.g. bearing vibration growth)

$$signal[i] = trend[i] + \alpha * noise[i], \alpha > 1.$$

Decrease dispersion (e.g. sensor failure)

$$signal[i] = trend[i] + \alpha * noise[i],$$
$$1 > \alpha > 0.$$

Trend shift (e.g. power surge)

$$signal[i] = signal[i] + shift.$$

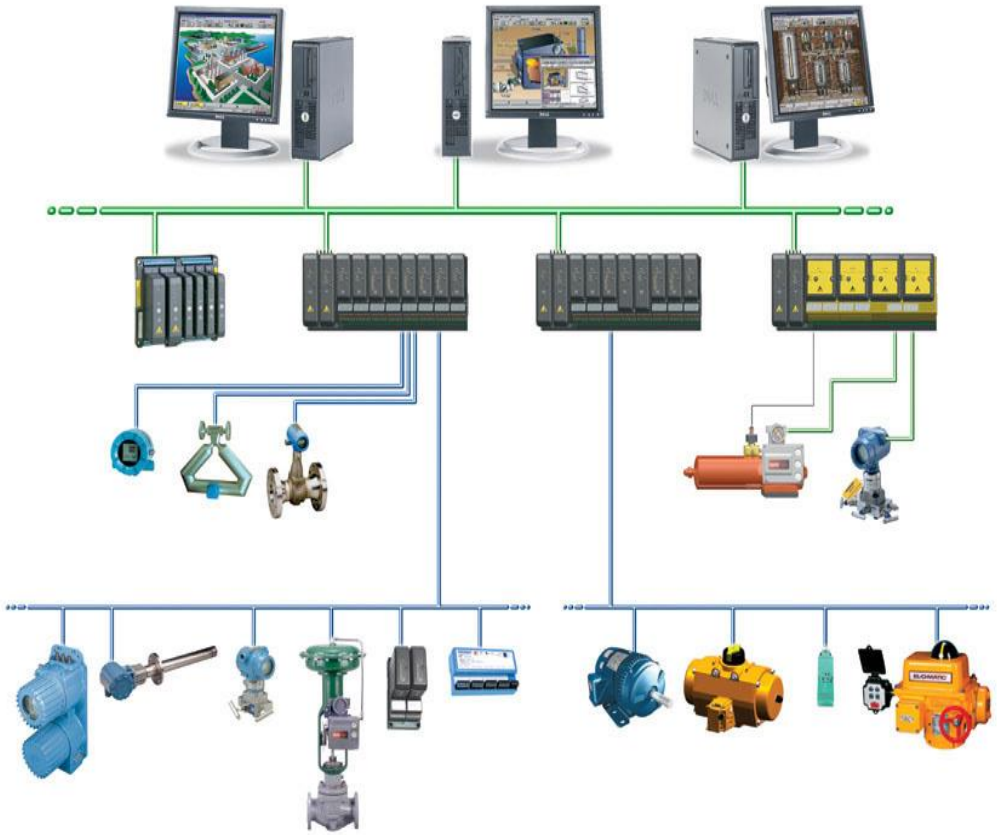
Add noise (e.g. interference to signals)

$$signal[i] = signal[i] + noise(0, \sigma).$$

where α-degree of anomaly

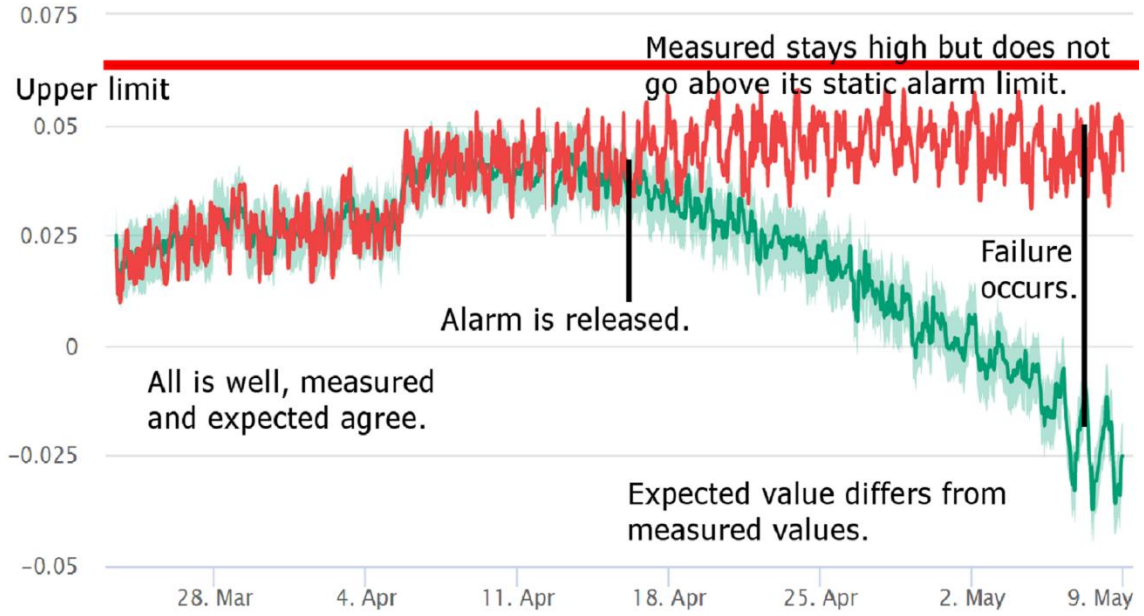
DEVELOPMENT: INDUSTRIAL DATA ANALYTICS CHALLENGE

DCS and SCADA



Process signals

Time series analytics



Process signals are

- variable
- noisy
- non-stationary
- extremely hard to analyze by standard control systems or by any person

Thanks for attention

e-mail: zamyatin@mail.tsu.ru