AI-enabled predictive analytics and risk score in healthcare
NON-COMMUNICABLE DISEASES (NCD) ARE THE MOST IMPORTANT CAUSE OF MORTALITY IN ALL COUNTRIES:

71% of all deaths in the world

4 TYPES OF DISEASES

- Cardiovascular diseases (every third death in the world)
- Cancer diseases
- Respiratory diseases
- Diabetes
- Other diseases (Alzheimer's d., Parkinson's d.)

Main GOAL is to reduce the total mortality rate of these diseases by 25% until 2025.

DIRECTIONS:
- Comprehensive prevention
- Risk factors prediction
- Informing the population about suspected diseases at an early stage

https://apps.who.int/iris/handle/10665/274512
Technology features:

- **integration** with Electronic health records (EHR)
- **extraction** of full EHR documents and features
- **complexed approach** to the analysis of the text data (including **NLP**)
- **producing** Data Sets for **ML**
- **analysis** de-identified electronic health records to determine diseases and clinical conditions
- **risk factors prediction** by machine learning and deep learning models

Clinical advantages:

- **various** disease assessment
- **integration** of different approaches to the clinical conditions
- **own methods** to the healthcare management
- **targeted recommendations** to physicians and patients

*Webiomed* is the first Russian software that was registered as a medical device in the field of artificial intelligence

[http://webiomed.ai/](http://webiomed.ai/)
Webiomed.CheckUp
Prediction of suspected disease based on data analysis, form recommendations for doctors and patients

Webiomed.NLP
Extract features from unstructured formats in EHR

Webiomed.DataSet
Accumulation of de-identified data from medical records, data set production

ACCUMULATED DATA
822 thousand
Digital twins
6 million
Causes
25 million
Medical records

The service provides risk assessments of various diseases, including the development of atherosclerosis and its complications, the risk of thromboembolic complications in patients with arrhythmias, the risk of cardiac arrest in hospitalized patients, the total risk of atherosclerosis and its complications, the risk of thromboembolic complications in cardiac arrhythmias.

During the COVID-19 pandemic, a very relevant option is to detect the severity of patients with pneumonia. A model for the automatic detection of suspicion on COVID-19, as well as an assessment of the patient's risk group for coronavirus infection is being developed. Identification of high-risk patients allow us to predict the risks of severe COVID-19, the need for mechanical ventilation / hospitalization in the ICU, and death.
HOW DOES WEBIOMED WORK?

Data preprocessing (format-logical control, NLP)
Data analysis (algorithms, scales, neural models)

Extraction of risk factors
Predictions of the group risks for different diseases

De-identified electronic health records (JSON)

Results are sent to EHR (report, JSON, HTML)

Creation of targeted recommendations to physicians and patients according to the clinical guidelines

EHR, EMR
Published risk assessment

Extraction of additional risk factors

Identification of hidden diseases

Prediction of the diseases suspicion

Group risk predictions of diseases: very high, high, moderate, low

INPUT:
EHR

Health examinations
Lab tests and diagnostics
Instrumental data
Clinical examination results
Ambulance calls

ANALYSIS METHODS:

MACHINE LEARNING

Published risk assessment

Regulatory requirements analysis

Clinical recommendation algorithms

RESULTS:

Forecast of a critical event (complications)

Identification of hidden diseases

Clinical recommendation

Prediction of the diseases suspicion

Group risk predictions of diseases: very high, high, moderate, low

Types of diseases
DEEP AND MACHINE LEARNING MODELS TO IMPROVE CARDIVASCULAR RISK PREDICTION

GOAL: to compare both methods to CVD risk prediction based on extracted EHR data - machine learning and traditional risk scales

ML TECHNOLOGY

ELECTRONIC HEALTH RECORD → UNSTRUCTURED DATA → NLP → DATA SET

DEEP AND MACHINE LEARNING MODELS TO IMPROVE CARDIVASCULAR RISK PREDICTION

Patient Cohort

- Total – 3 652 (have all features: vital signs, diagnoses, medications)
- Average age – 49.4 (21-75)
- Female - 68.2%

CONCLUSION

✓ The machine learning outperformed a traditional clinically-used predictive model for CVD risk prediction.
✓ This approach was used to create a CDSS. It uses both methods: traditional risk scales and models based on neural network. The system can calculate the CVD risks automatically and recalculate immediately after adding new information to the EHR.
During work with EMR physicians he can ask for artificial intelligence’s advice. They push the bottom in a workflow. EMR automatically analyzes the electronic and sends to Webiomed de-identified data set.

Webiomed returns the identified risk factors and the appropriate assessment of group patient risk. The results shows on the system website page. The answer contains of detailed explanations and further recommendations for doctors and patients.
Webiomed extracts DATASET

The service allows to collect the depersonalized medical data base and to produce data sets for further training of neural networks, clinical studies and clarification of hidden dependencies.

- **Social data**
  - Date of birth, gender
  - Region of residence
  - Social category, education, etc.

- **Anamnession and signaling information**
  - Registered Diagnoses
  - Height, weight, waist circumference
  - Smoking
  - Heredity

- **Medical documents**
  - Instrumental and laboratory examination protocols
  - Medical Examination Protocols
  - Clinical examination results
CONSUMERS

**B2G**
Webiomed helps doctors to make good decisions and save time

**B2B**
To increase the effectiveness of national prevention and screening programs

**B2C**
To increase the effectiveness of national prevention and screening programs

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**PHYSICIANCE**
Healthcare Managers
Insurance Company
Services for Patients

**EHR**
Integration with EHR

**PHARMA**
Data analysis
Intellectual property

CERTIFICATES

Certificate for Webiomed trademark
No. 609678 dated 25.12.2017

Certificate for registering PC software
“Clinical Decision Support System Webiomed”
No. 2018661424 dated 07.09.2018

Software is being registered as a medical device in Roszdravnadzor

KEY PUBLICATIONS


2. Gusev A.V., Pliss M.A. The main recommendations for the creation and development of information systems in health care based on artificial intelligence.


4. Gusev A.V., Dobridnyuk S.L. Artificial Intelligence in medicine and healthcare
   Information society. No. 4-5, 2017, pp. 78-93

5. Gusev A.V., Zarubina T.V. Support of making medical decisions in medical information systems of a healthcare organisation

6. Gusev A.V. Creation of regional fragments EGISZ/USISHC Unique State Information System in the Health Care: current results and analysis of programs on further development of information systems in the healthcare

7. Tavrovsky V.M., Gusev A.V. What should healthcare informatisation lead to? Attempting to design the future
   Physician and information technologies. No.5, 2011 pp. 60-76

8. Gavrilo D.V., Gusev A.V., Kuznetsova T.Yu., Dudanov I.P. Automatic formation of arterial hypertension diagnosis at hospital working in the integrated medical information system
   Link Medical academic journal. Volume 5. No.
PROJECTS

Regional pilot projects:
• Yamal-Nenets Autonomous Okrug
• Kirov region
• Republic of Karelia

Industry projects:
• Project with the Association “National base of medical knowledge”
• Project with FMBA of Russia
• Skolkovo’s resident
OUR PARTNERS

SKOLKOVO
The Skolkovo Innovation Center is a high technology business area in Russia

PETROZAVODSK STATE UNIVERSITY
Petrozavodsk State University is the Flagship University of the Republic of Karelia

FEDERAL STATE BUDGET ORGANIZATION NATIONAL MEDICAL RESEARCH CENTER OF CARDIOLOGY OF THE MINISTRY OF HEALTHCARE (Russia)

NATIONAL BASE OF MEDICAL KNOWLEDGE
The Association of Developers and Users of Artificial Intelligence Systems in Medicine

MEDICAL PREVENTION CENTER
YNAO Health Organization for prevent diseases

ASSOCIATION OF CLINICAL PHARMACOLOGISTS
This is the largest organization of clinical pharmacologists in Russia. Established in 2009

AWARDS and ACHIEVEMENTS

Digital Health Awards
Grand Prix nominee as Startup of the Year at the Digital Health Awards

ПРОФ-ИТ.2019
Prize winner in the nomination: “Best Innovative Project”

#ИТМ 2019
Laureate of the contest "The best IT Solution for healthcare"
We are a balanced team of experienced specialists in IT, AI and Healthcare medicine!
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