# AI-BASED DECISION SUPPORT SYSTEM to PREDICT the SEVERITY of ACUTE PANCREATITIS

HU-MATHS-IN
Hungarian Service Network for Mathematics in Industry and Innovations

## CHALLENGES

**Health, demographic change and wellbeing**

**The Problem**

The problem is to **predict the severity of acute pancreatitis** using advanced machine learning algorithms, based on data that are available **at the time of hospitalization**.

DATASCIENCE IN HEALTHCARE

*Research group*

**Human and Social Data Science Lab**

**Budapest University of Technology and Economics**

HSDSLab
Human & Social Data Science

MŰEGYETEM 1782

We translate research into lasting impact in the social, human, and business context

*Company*

**Translational Medicine Center**

TM
TRANSZLÁCIÓS MEDICINA Központ

The aim of TM is to promote the practical application of scientific results and innovations in health care

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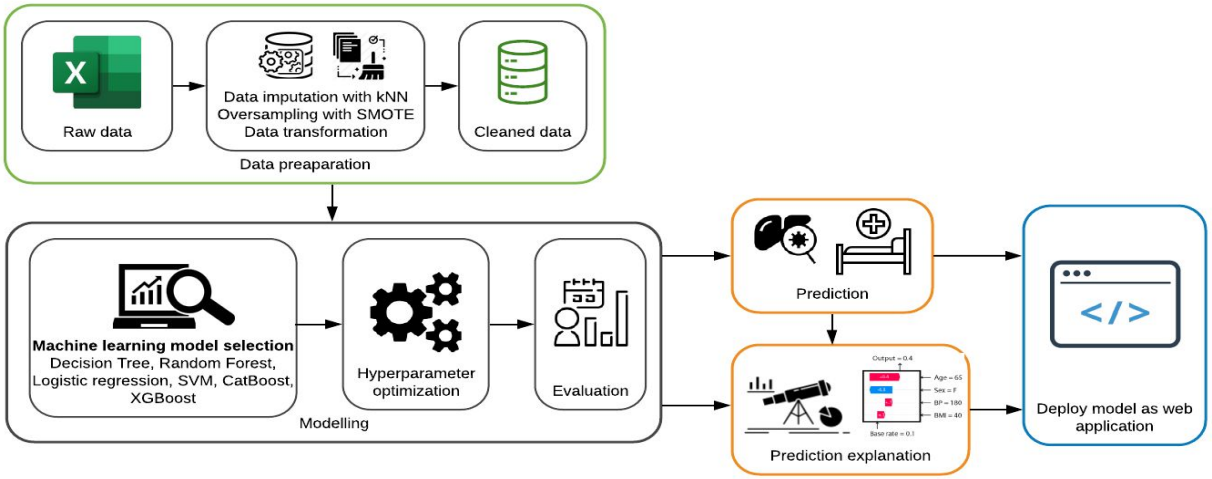
## Challenges & Goals

- Roughly **15-25%** of all patients with acute pancreatitis (AP) **develop severe** AP.
- The **mortality** from AP is very high in subgroups of **patients with severe disease**
- Our **goals** are
  - to **predict** whether a patient will develop **severe acute pancreatitis** or not, based on data that are available at the time of hospitalization
  - to **identify** the most important **factors** and their contribution to the prediction using the tools of **explainable** artificial intelligence (XAI)
  - to **develop** a web **application** that gives a prediction (severity score) for a given input (measurements of a patient) and explains the prediction of the machine learning model.




*The illustration of the workflow of this project*

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## Mathematical and computational methods and techniques applied

- The prediction of the severity of acute pancreatitis is a binary classification problem.
- Positive (severe) class is only 6%, we applied SMOTE to oversample the data of the severe patients.
- We imputed the missing data with a nearest-neighbor-based imputer algorithm.
- The best-performing model was the gradient boosting tree based XGBoost algorithm.
- The models were evaluated using the accuracy, average precision, and area under the ROC curve.
- We used a game-theoretical concept-based technique, called the SHAP value, to explain the predictions of the model.
- We used a bootstrapping method to estimate the confidence of the prediction of the model

*A mild case*


*A severe case*


*The contributing features push the prediction from the base value (mean severity score) to the predicted severity score.*

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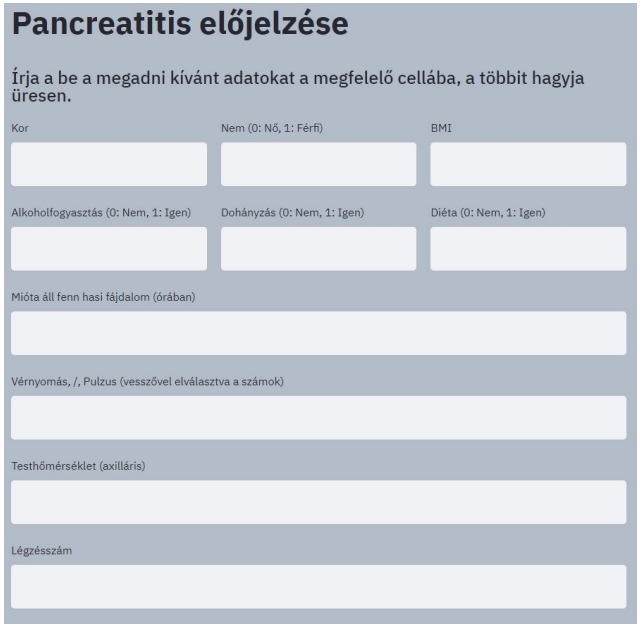
## Results & Benefits to the company

- Used advanced machine learning models to **predict** the **severity** of acute pancreatitis based on data that are only available at the time of hospitalization
  - XGBoost: Accuracy = 84%, AUC = 0.82
- Developed an AI-based decision support system that
  - by identifying the patients at-risk, **helps the** early triage, i.e. the **assignment of degrees of urgency**
  - provides explanations to the predictions that **help physicians understand why** the patient is at-risk
  - can be an **educational** app **for** the **patients** since it **highlights the contributing factors** that push the severity score higher




*A screenshot of the developed web application*

The application assists assignment of degrees of urgency, moreover, by highlighting the key contributing factors it helps both physicians and patients understand why the patient is at risk of developing severe acute pancreatitis.