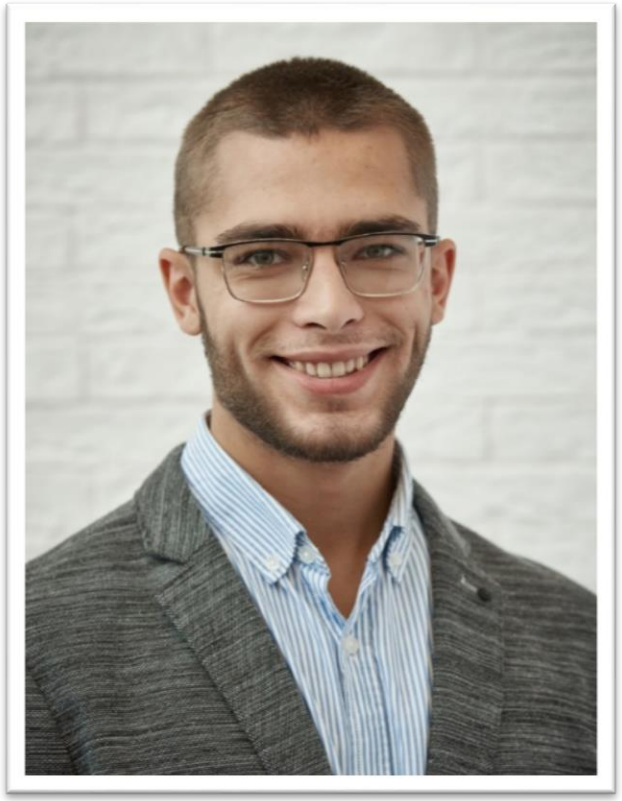
# Development of technology for the detection of corrosion on pipelines using neural networks

Speaker: Tsvetkov Nikolay Viktorovich

Gazprom transgaz Saint-Petersburg

# Команда проекта



**Bryukhanov Maxim**

Tumen State University

2nd year master's student

**Pichugin Zakhar**

Skolkovo institute of science and technology

2nd year master's student

**Tsvetkov Nikolay**

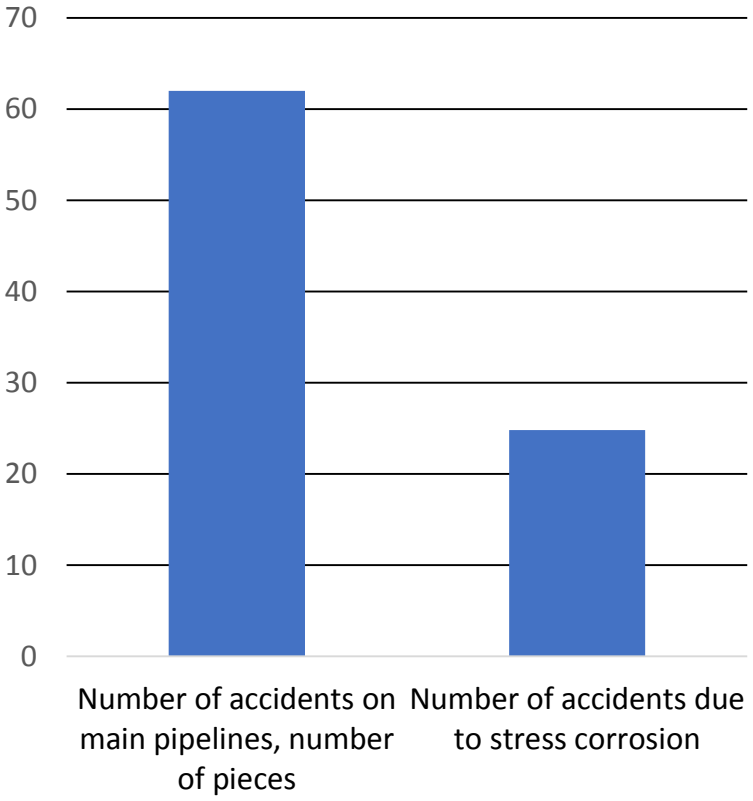
Gazprom transgaz Saint-Petersburg

Technological compressor operator

# Issue

250 thousand km

Number of accidents at facilities main pipeline transport from 2015 to 2019




**73%** of pipelines were built over 20 years ago

**25** years is the average service life of a gas pipeline

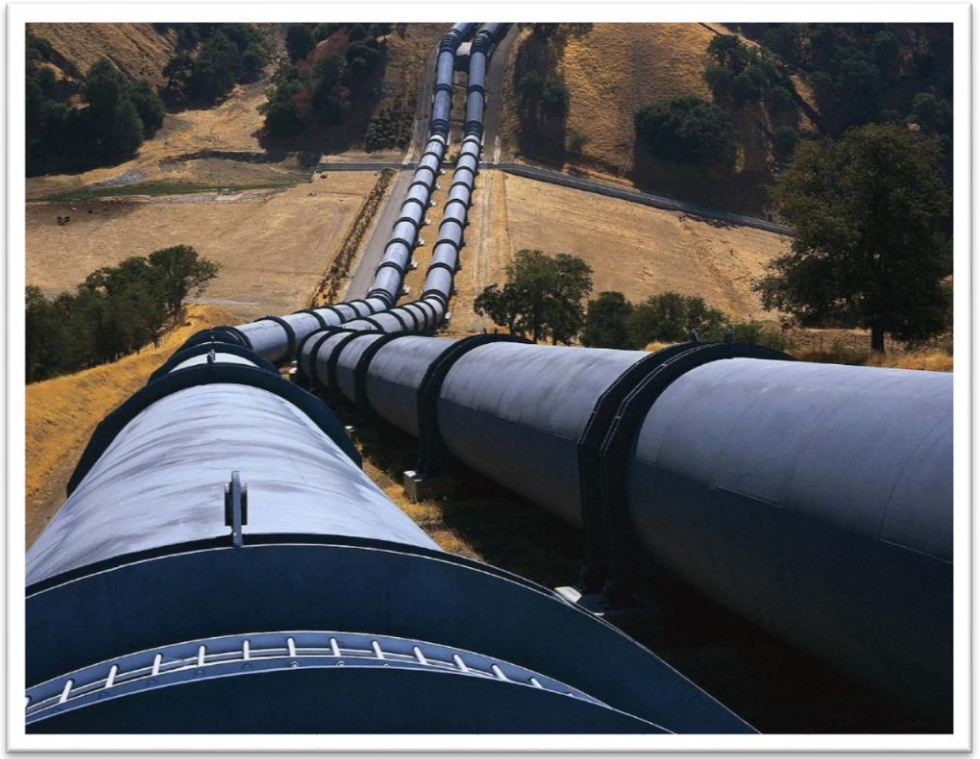
**1,5** billion rubles accounted for damage from accidents over the past 4 years

**В 10** times the cost of diagnostics has increased over the past 6 years

# Existing solutions

## Method of statistical forecasting of damage to the main gas pipeline by SCC-defects

- ✓ Consideration of important factors
- ✓ Low price estimate
- ✗ Human factor
- ✗ Failure to assess the cumulative impact of various combinations of underlying factors
- ✗ Weak factors are not considered



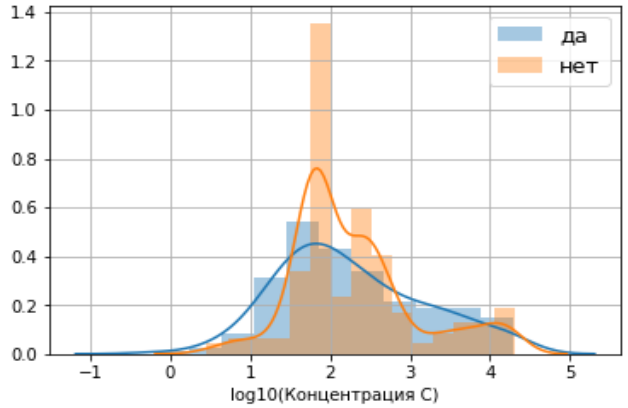
👉 Ball system - SP 86.13330.2014 "Trunk pipelines"

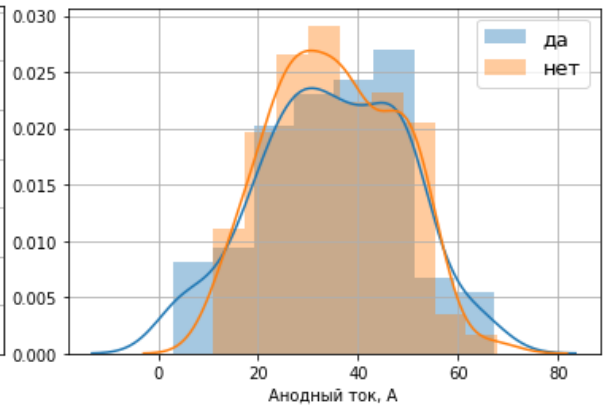
# Decision

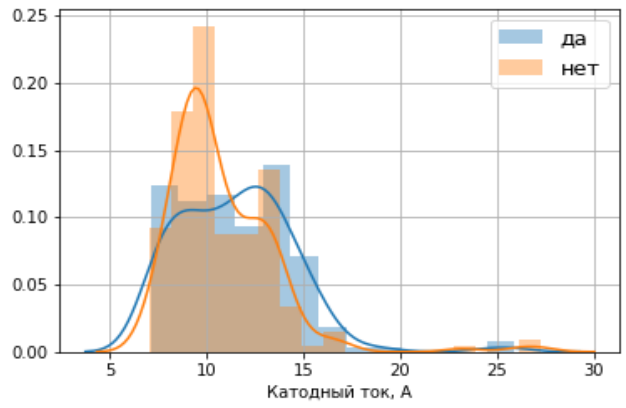
- High quality raw data processing
- Using modern methods of machine learning and neural networks
- Using suitable metrics for binary classification problems
- Software prototype development
- Using the Python programming language (scikit-learn libraries, pytorch, etc.)
- The result of the program is a value that characterizes the probability of the presence of corrosion in a given area

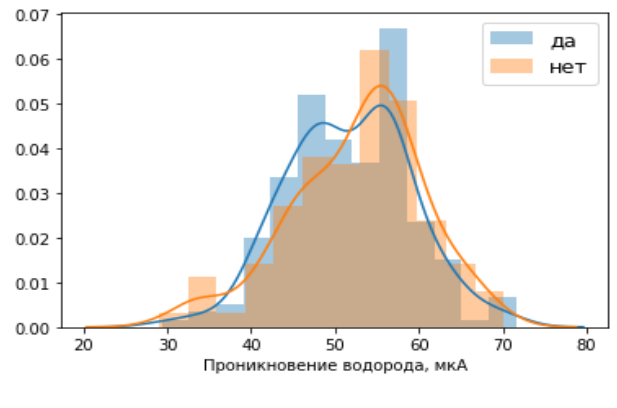
```
import pandas as pd

from sklearn.datasets import make_moons, make_circles

from sklearn.model_selection import cross_val_score, train_test_split
from sklearn.ensemble import RandomForestClassifier
from sklearn.linear_model import LogisticRegression
from sklearn.svm import SVC
```

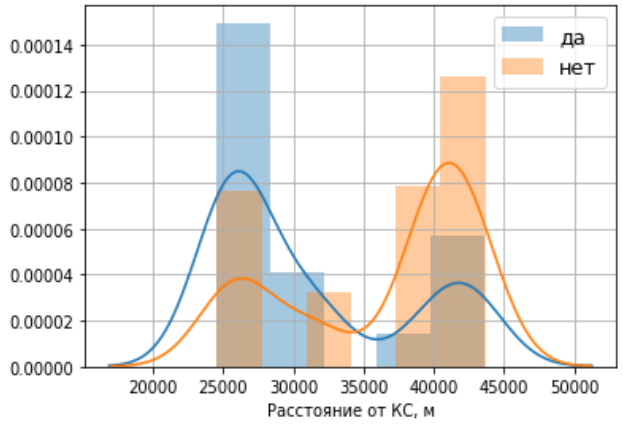
# Data analysis

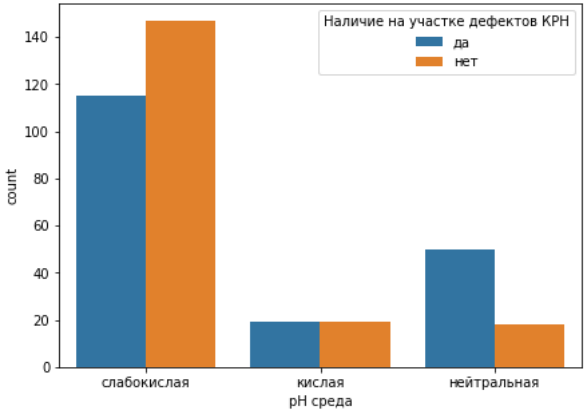


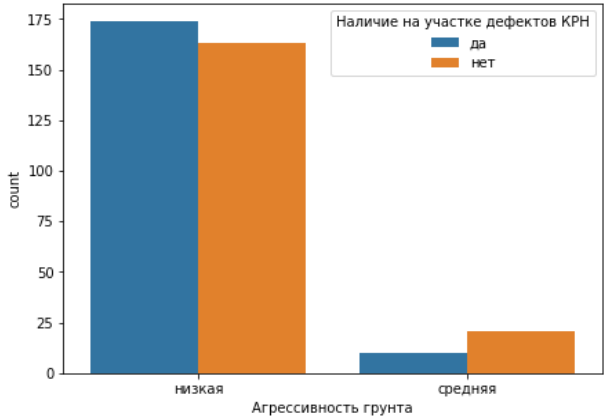



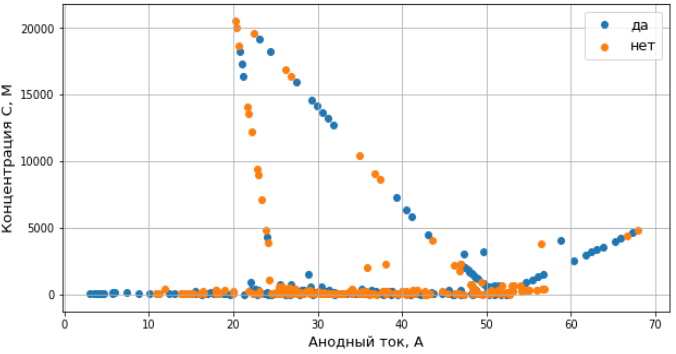



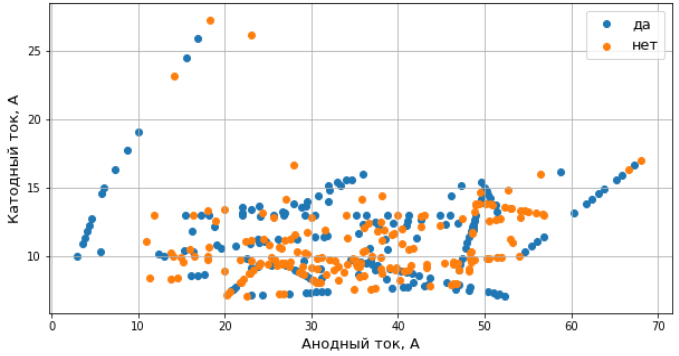



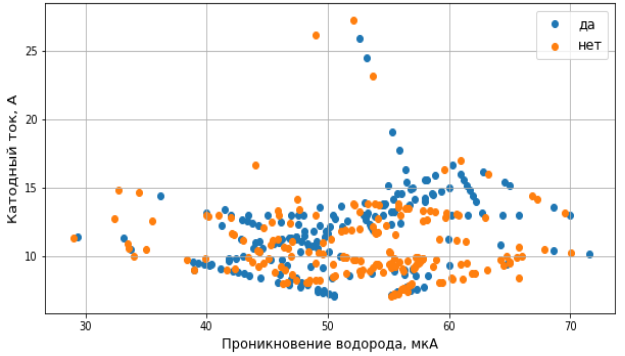



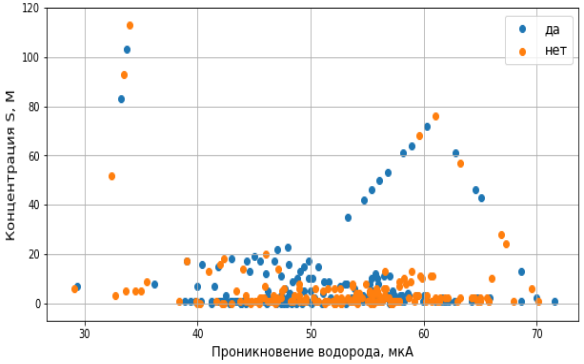




| pH среда | Наличие на участке дефектов КРН | |
|---|---|---|
| кислая | да | 19 |
| | нет | 19 |
| нейтральная | да | 50 |
| | нет | 18 |
| слабокислая | да | 115 |
| | нет | 147 |



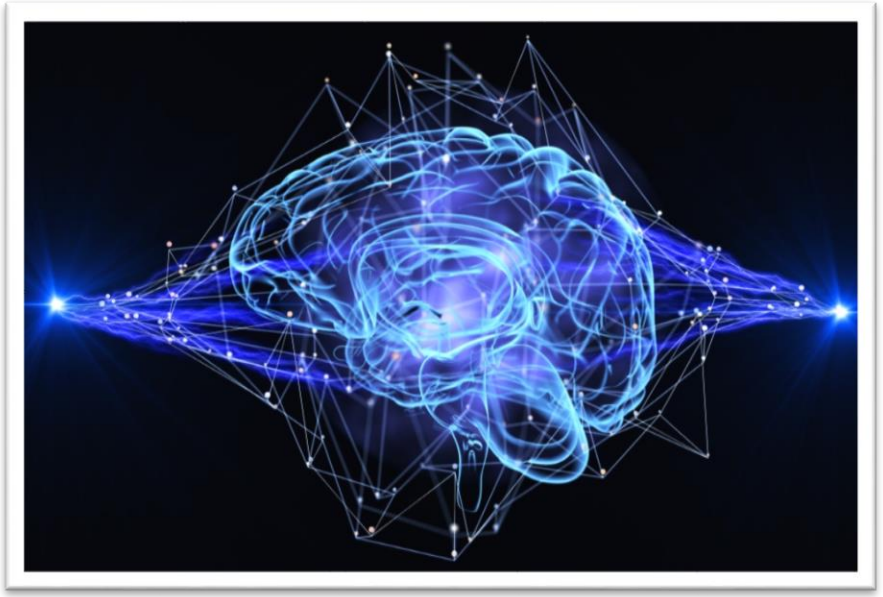



# Results of work

The analysis of the following classification options:

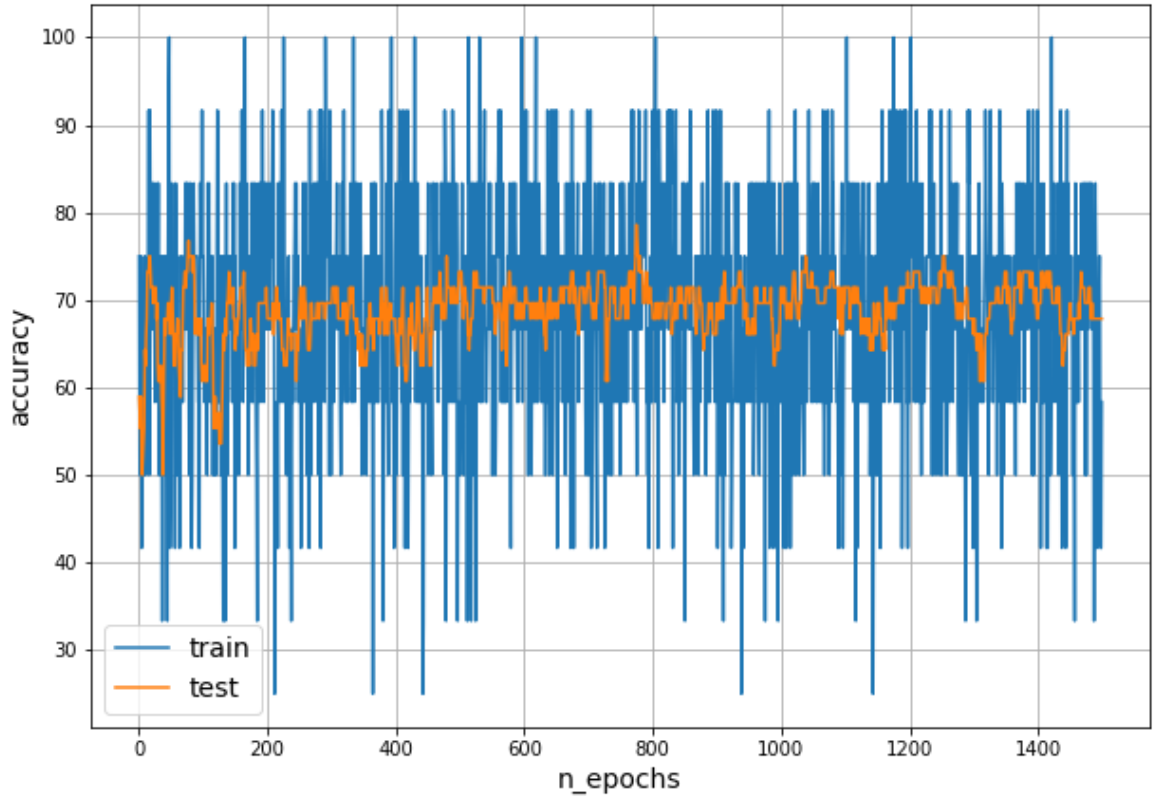
- LogisticRegression
- CatBoost classifier
- RandomForestClassifier
- DecisionTreeClassifier
- KNN
- SVC
- A neural network with the following network architecture: three hidden layers: 17, 51 and 17 neurons



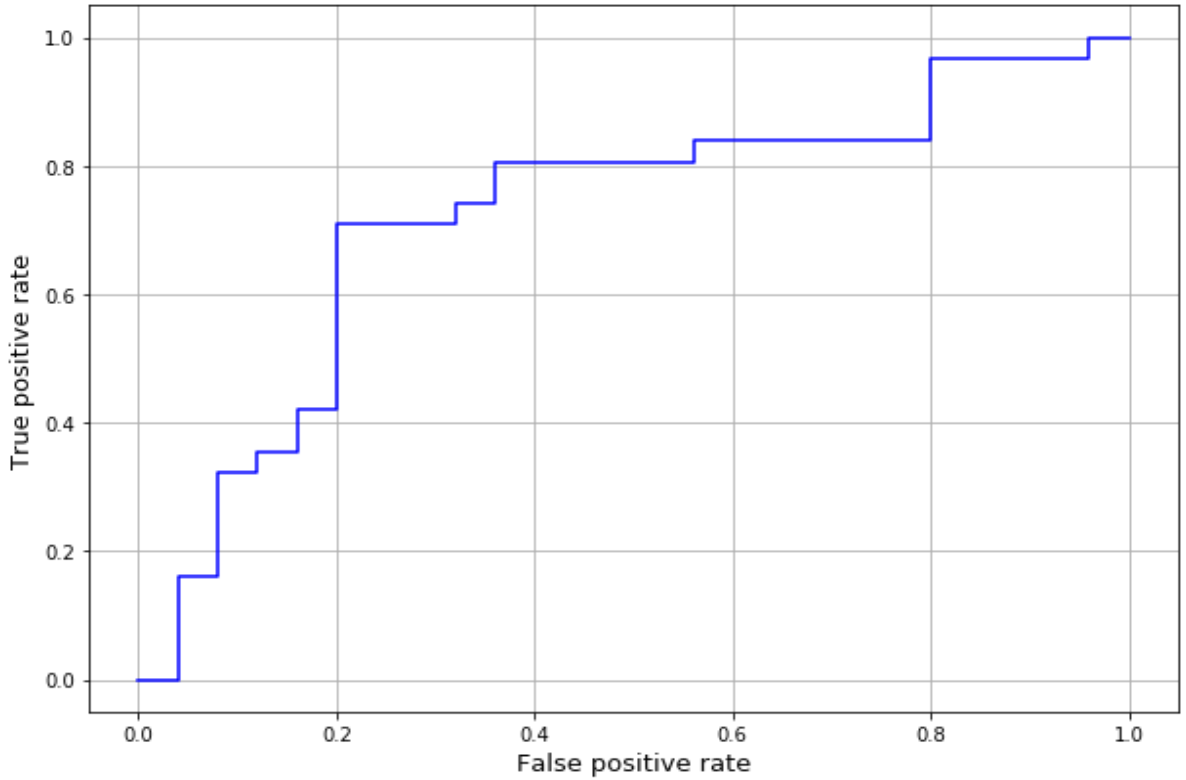
LogisticRegression – 86.5% on the training and 75% on the test sample

Neural network - 100% on the training and 78.6% on the test

# Results of work

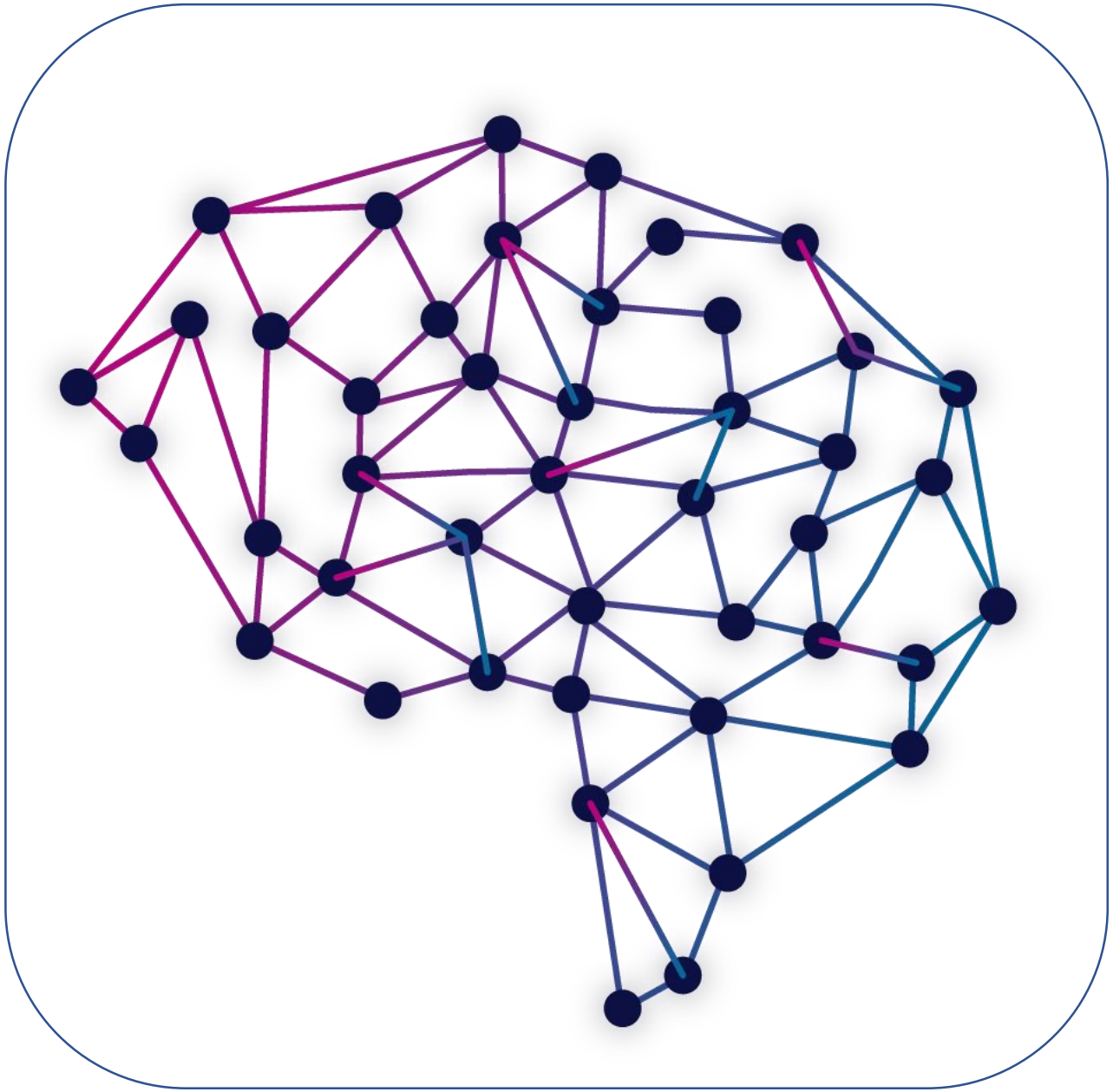



Neural network training chart




ROC-curve for neural network

Accuracy 78,6%



# Thanks for attention!


Tsvetkov Nikolay Viktorovich

TSNV97@yandex.ru

+7 911 946 20 52


ГАЗПРОМ ВНИИГАЗ

ГАЗПРОМ ТРАНСГАЗ САНКТ-ПЕТЕРБУРГ

Skoltech
Skolkovo Institute of Science and Technology

ТЮМЕНСКИЙ ГОСУДАРСТВЕННЫЙ УНИВЕРСИТЕТ
1930