According to the World Health Organization WHO, the ending of pregnancy after the 22nd week and before the end of the 37th week of its duration is a preterm labour. It results in the so-called prematurity, which is the most common cause of neonatal death in Poland. The risk of death of an infant born from preterm labour is more than twenty times higher than in the case of a child born at term. The longer the duration of pregnancy, the higher the chances of survival of a newborn baby. Therefore, it is necessary to develop an effective, non-invasive method for predicting the threatened preterm labour, providing support for the physician. In the authors opinion, it may be accomplished by an automated classification of registered fetal biophysical signals (cardiotocographic and electrohysterographic) using computational intelligence methods, which is the research topic of the proposed project.

First methods applying the computational intelligence for the automated evaluation of the fetal state have used an artificial neural networks. Another group of early methods constitutes procedures based on fuzzy sets and fuzzy logic theory. Nowadays, the most effective solutions (with the highest generalization ability) are designed using the principles of the statistical learning theory.

Despite many studies concerning the automated assessment of the fetal state, a research studies are still being conducted on improving both accuracy and interpretability of the solutions obtained. Interpretability is particularly important for the physician, and in the case of solutions based on statistical learning theory it is significantly hindered. The methodology of the research proposed in the project is based on the statistical learning theory. The second source of inspiration are the fuzzy modeling techniques, which combined with the statistical learning theory resulted in the formulation of ε-insensitive learning. The ε-insensitive learning is based on the premise that human learning and reasoning is tolerant to imprecision. The project will develop new techniques of fuzzy clustering inspired by the ε-insensitive learning, that will be used to determine interpretable fuzzy conditional rules of the classifier. As a result, the proposed work is aimed at developing a system of automated classification of fetal biophysical signals, to predict the threatened preterm labour, characterized by the generalization ability comparable to the best solutions known from the literature, as well as of high interpretability.

In case of the considered research material the data can be described as uncertain, incomplete and unbalanced. The basic cause of uncertainty is the nature of measurement procedures. Data incompleteness may result from the collection of research material from various research centers. In turn, the unbalancing of the data consists in the fact that the research material contains much fewer cases (signals) corresponding to the premature labour than the labour at term. Considering the above, the fuzzy clustering methods developed within the project will be adapted to the specifics of the analyzed data.

The research results will be published in the form of scientific papers in highly recognized scientific journals as well as presentations at major international conferences. As the particularly interesting form of spreading of the research results, the authors perceive publication in the Internet and making the database, developed for the needs of the project, available through the "The Research Resource for Complex Physiologic Signals" (www.physionet.org).