Particle Physics aims at describing the laws governing the smallest constituents of matter — elementary particles. Because all matter is composed of elementary particles, Particle Physics is a branch of science that studies the most basic and essential properties of the surrounding world. The field became widely recognised thanks to the construction of the Large Hadron Collider (LHC) where the famous Higgs boson, known also as the "God particle", was discovered in 2012. It was a major achievement for the Particle Physics, because it confirmed one of the last missing predictions of the current paradigm known as the *Standard Model of Particle Physics (SM)*, which is a complex theory explaining all physical interactions except for the gravity that is still described by over a hundred years old Einstein's General Relativity. Standard Model has been proven to be very successful at providing extremely accurate predictions on various physical processes, however, physicists believe it has to be exchanged by some superior theory, which would take gravity into account and treat all interactions in the nature in a similar manner. Moreover, it should explain the existence of the Dark Matter — an exotic and unknown type of matter that alters the movement of galaxies.

Therefore, the present-day Particle Physics aims at discovering this new and unknown physics. Various theoretical models were proposed in recent decades, and numerous experimental studies were conducted. Unfortunately, the New Physics has not been found at the LHC so far, which makes us think that the currently used methods need to have some sort of a flaw. We believe that there are two main issues with current searches for the New Physics. First, the algorithms used to search for the signs of the New Physics target only a narrow subset of LHC data, and do not take into account correlations between many different subsets, which may cause them to overlook signs of an unknown physics. Secondly, the current search methods always assume a certain type of Physics to be searched for. However, if the New Physics is significantly different from our speculations, the present analyses will be blind to it.

To overcome these issues, we propose a project **"Developing a new direction for collider BSM searches with Machine Learning"** in which we implement Machine Learning techniques that are successfully used for face and voice recognition, autonomous vehicle driving, personalised advertisement and many other applications. We represent physics data as images, and we use methods borrowed from image recognition studies to enhance our data analyses. We start by improving searches for the Dark Matter at LHC, by developing algorithms which are more sensitive than present analyses. Next, we propose an ambitious project, in which we construct a method to search for a New Physics with a minimal set of assumptions and within many different subsets of data, unlike currently used methods. It is based on a state-of-the-art Machine Learning algorithms, which learn the characteristics of Standard Model Physics, and search for any deviations in the data. Finally, we use our tools to construct new analyses, which we comprehensively test and compare with existing results.

The expected result of our study is a set of data analysis tools and methods, which will allow to increase the accuracy of searches for a New Physics at the LHC and its successors. What is more, a novel approach will be developed, allowing to more efficiently look for signatures of a New Physics. In addition, we will provide improved constraints on existing theoretical models.

It is possible that our research will influence experimental studies leading to a discovery of a New Physics and a major breakthrough in Particle Physics field.