Problem statement

You work for Classical-IT, a well-established information technologies (IT) consulting firm with offices around the world. Classical-IT has activities ranging from the developement of database systems for inventory management to custom expert software for the mining industry. Classical-IT has heard about quantum computing and the growing interest for it, and especially for its potential applications to solving real-world problems. Classical-IT has missed the artificial intelligence and machine learning revolution and doesn't want this to happen for the quantum computing revolution. For this reason, the R&D department of Classical-IT has hired a little team of individuals with diverse science and engineering backgrounds. You are part of this team, who's mandate is to start exploring quantum computing and its opportunities for Classical-IT's business. More specifically, the chief strategy officer at Classical-IT has identified quantum machine learning (QML) as an area of interest in future technologies for the company's growth. She requires that your team develop a proof of concept for an application of QML of you choice. You will have to present a poster of your work at the company's board of directors (BOD) meeting. As higher management people are very busy, you will only have 3 minutes to make your presentation to convince the BOD that it is well worth investing in developing in-house expertise in quantum computing.

The procurement department of Classical-IT has already signed a partnership agreement with PINQ2. Through this partnership, Classical-IT has some privileged access to IBM quantum computers. Your experience with quantum programming and QML is yet limited, but your boss allowed you and your team to register to a specialized workshop on this topic. During this workshop, you will learn about data embedding, along with algorithms such the quantum-enhanced support vector machine (QSVM) and the variational quantum classifier (VQC) model. You will also be exposed to the technicalities of QML such as gradients, error mitigation, and dimensionality reduction. In the workshop, you will also get sample code that will help you develop your QML application. This application will be coded in Python using IBM's open-source software development kit (SDK) called Qiskit. The workshop will also introduce you to Qiskit runtime. To spare precious computing time on IBM's quantum computing hardware, the procurement department forwards you the advice of IBM experts with which they talked to that you first test your prototype code on the simulator provided by IBM. To carry out your code development and manage it efficiently, your company requires that you use GitHub, which is standard in industry. Your GitHub repository must be accessible to the company at all times.

The poster you will present to the BOD shall help you describe your solution to the problem you will have selected. Furthermore, since the company is considering investing in human resources in quantum computing as your team, your poster shall contain information on the way you worked as a team, how you managed your code, and the software engineering process you applied. The poster shall follow best practices in poster preparation and presentation.