# AI doctor / assistant

## The task:

Create a quantum driven medical AI doctor or assistant.

## The problem:

While nowadays the accuracy of AI assistants isn't very high, it is very important to diagnose diseases correctly, which requires huge computational resources to train tools, such as RNN. Moreover, power for traditional supercomputers is very expensive and harms the environment. Moreover, state-of-the-art technologies, for example ChatGPT, consume huge amounts of time and power for training with daily expenses of $100,000, highlighting the financial difficulties associated with these models. Also, the environmental impact is substantial, as training an average size generative artificial intelligence model, such as LLM, emits about 300 tons of CO2. Moreover, the use of AI requires significant energy expenditure. It was reported that creating 1,000 images using a generative artificial intelligence model, such as Stable Diffusion, has a carbon footprint equivalent to driving 4.1 miles in an average car. According to the report, data centers supporting generative artificial intelligence answer for 2-3% of global greenhouse gas emissions.
By using quantum computers, we can try to fix these problems since quantum or hybrid quantum-neural networks can increase the accuracy while decreasing parameters, which means faster RNN training and less ecological damage.

## The expected impact:

- improve the availability of medical professionals,
- improve the accuracy of diagnosis,
- reduce the costs of medical assistance,
- predict diseases,
- enable faster and more accurate medical replies using AI agents (LLM, CNN, other)
- improve the economic viability of AI,
- improve the sustainability of AI usage.
- use AI techniques, such as a quantum or hybrid small language model based on recurrent neural networks (RNN) or other,
- use your own or provided datasets to train the model and show advantages over classical models.
- achieve other benefits for patients and/or medical professionals.

## Challenge specific guidelines:

- Economic: reduce the financial burden associated with training and utilizing AI models. This could involve optimizing hardware usage, minimizing parameters, or exploring alternative computing paradigms, such as hybrid quantum-neural networks.
- Environment: Come up with new ideas to make AI technology better for the environment. Propose innovative solutions to mitigate the environmental impact of AI, reducing carbon emissions and energy consumption related to AI training and usage.
- Performance Optimization: Make AI models work better and faster while keeping them efficient. Enhance the functionality and performance of AI models while minimizing the impact of parameter reduction or alternative computing approaches.

- Quantum Computers: Explore how quantum computers can improve AI for a mutual impact on healthcare worldwide. Investigate the potential of quantum computing in addressing the limitations of classical computing paradigms, such as representation accuracy or processing bottlenecks.

These problems are primarily related to the architecture of generative artificial intelligence, which intensively uses parameters, incorporating billions of parameters trained on extensive datasets. This training process is based on powerful hardware, such as graphics processors or TPUs, specially optimized for parallel processing. Although this specialized hardware increases the efficiency of training and using generative artificial intelligence models, it also leads to significant costs associated with manufacturing, maintenance, and energy consumption for operating this equipment.

Consequently, efforts are currently underway to enhance the economic viability and sustainability of generative AI. A prominent strategy involves reducing the generative AI by minimizing the extensive parameters in these models. However, this approach raises concerns about the potential impact on the functionality or performance of generative AI models. Another direction being explored is to eliminate bottlenecks in traditional computing systems used for generative artificial intelligence. Researchers are actively developing analog systems to overcome the von Neumann bottleneck, which separates processing and memory, leading to significant communication overhead.

In addition to these efforts, a less explored area includes problems within the classical paradigm of digital computing used for generative AI models. This includes representing complex data in binary digits, which can limit accuracy and affect computations during the training of large generative AI models. More importantly, the sequential processing paradigm of digital computing creates bottlenecks in parallelism, leading to increased training time and higher energy consumption. To address these issues, quantum computing represents a powerful paradigm.

A recurrent neural network (RNN) is a type of artificial neural network designed to recognize patterns in sequences of data, such as text, genomes, handwriting, or numerical time series data. Unlike traditional neural networks, RNNs have loops within them, allowing information to persist by passing previous output as input to the next step, which enables them to exhibit temporal dynamic behavior and understand context within the sequence.