# Details of Research Project

## Section A: Overview of the Research Project

**1. Academic level (Masters or PhD):** Masters

**2. Broad field of research:** Engineering

**3. Title of the research project:** A comparison framework for RFI detection algorithms

**4. Research project abstract:**

The goal of this research is to develop a comparison framework which will allow us to compare the various RFI approaches that have been developed with one another (those that involve machine learning and those that do not). A similar framework has already been developed for Radio Galaxy Morphological Classification. To develop such a framework we need to use simulated data, for this purpose a simulator like *hera_sim* can be used.

**5. Primary Supervisor's Details:**

**(a) Supervisor's title and full name:** Dr. Trienko L. Grobler

**(b) Name of the South African or SKA Partner Country university at which the primary supervisor is a permanent academic staff member:** Stellenbosch University

**(c) E-mail address and/or contact telephone number:** tlgrobler@sun.ac.za | 0729897528

## Section B: Details of the Research Project

**1. Scientific merit:**

With the rise of different Deep Learning techniques and their use to detect RFI it is becoming crucial to develop a comparison framework, that can assess how well these algorithms are perfoming in terms of recognition performance. This framework should also be able to ascertain the computational complexity of the different techniques. This will enable us to choose the best approaches for deployment. Recently a similar framework was proposed for the Morphological Classification of Radio Galaxies.

One of the major obstacles to achieving this goal was proper groud truth data. Recently, however, RFI simulators, like *RFISim* and *hera_sim*, have been developed. These simulators now make it possible to develop a testbed framework for RFI detection algorithms.

**2. Feasibility:**

Stellenbosch University offers access to a state of the art High Performance Computing (HPC) facility.

Initially, the student will work on gaining an understanding of interferometry, RFI and the various approaches that are used to detect RFI. As part of an MEng at Stellenbosch University the student will also be required to complete various other postgraduate modules that cover electromagnetics and antennas.

In the first year, a detailed literature study and revision of current machine learning approaches and how they have been used to detect RFI is expected. Getting a RFI simulator up and running is also crucial (one will be chosen after a properly investigating the available choices). The student will also have to implement some of the approaches in literature from first principles and in other cases only familiarizing themselves with existing software.

The goal of the 2nd year is to consolidate everything that was learned in the first year; culminating in the development of the testbed. This comparison framework will then be used to rank the existing algorithms in terms of recognition performance and computational complexity.

**3. Relevance of the research proposed to the SARAO priority areas:**

As RFI is one of the SARAO priority areas this research will be greatly useful for the SARAO. This framework can also be retrained using real interferometric data from the MeerKAT telsescope (see point 5.2.3 in the application guide).

Furthermore, the student will be knowledgable on interferometry and machine learning after their studies, which are valuable skills that can help further the SARAO priority areas.

**4.** Students with an interest in programming, machine learning, electromagnetics as well as computing will be ideal for this project.

Dr. T.L. Grobler - 2021-02-19