

COMP80142: A4

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1 Introduction

The UK nuclear power sector is dominated by the advanced gas-cooled reactor (AGR) [8]. This design differs from most reactors around the world in that it consists of a graphite core cooled by carbon dioxide gas (as opposed to the common water cooled reactor). The relatively unique design means that all safety analysis has to be performed domestically, leading to a significant requirement for computation. This analysis is highly expensive in terms of human effort and computer time. It has been suggested that AGR safety analysis could be made more efficient (and therefore lower cost) by using machine learning (ML). To this end, this research paper will discuss cross discipline research in the fields of nuclear energy and machine learning (ML).

The specific goal of this research project will be to use ML to produce a multivariate estimate of graphite brick distortion as a function of various metrics such as core age, design, operational temperature and crack configuration. This is a highly novel project within the nuclear industry, although there are comparable applications in the areas of computer vision and pattern recognition.



Figure 1: Hinkley Point B Power Station

2 Method

The research began by searching various relevant terms in Google Scholar. Search terms combining terms such as "nuclear", "energy" and "machine learning" resulted in a few potentially relevant papers being found, such as [9], [7], [12] and [10].

Through finding these papers, several others were found such as [11], [6], [4], [3], [2] and [1]. These papers might not have the same level of direct relevance as the aforementioned papers, however, they may have unique elements which may be useful to the over all project. For instance, [11] may aid in building a multivariate models and [2] may give insight into how results could be clustered before and after analysis.

Looking outside of the nuclear and energy industry, there are comparable examples in computer vision that are applicable to this project. For example in [5] a method is discussed which analyses pixels in an image and estimates their depth into the scene. This is regression technique, providing a multivariate continuous variable based on a large number of input features. This can be seen as very similar problem to the project.

3 Discussion

Several of the documents found are from the proceedings of the Conference on Computer Vision and Pattern Recognition. This is a high profile conference that is a major target for paper submissions within the computer science community.

The annals of nuclear energy is also an important journal, being a significant journal in the nuclear sector.

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