Vita

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An Algebraic Approach to Group Equivariant Neural Networks

UNIVERSITY OF NEW BRUNSWICK

THESIS DEFENCE AND EXAMINATION

in Partial Fulfillment

of the Requirement for the Degree of
Master of Science

by

Max R. G. Hennick

in the Department of Mathematics & Statistics

U.N.B., Fredericton, N.B.

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Via MS TEAMS

Examining Committee

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Abstract

In recent years, two distinct paradigms have been emerging in machine learning. The first is the “data driven" paradigm which makes minimal assumptions about the underlying structure of the data, and instead relies on huge swathes of data and very general algorithms to achieve state-of-the-art performance.

The other can be referred to as the \inductive prior" paradigm, which makes prior assumptions about the structure of data, and attempts to design algorithms which exploit this structure, i.e they have a “prior belief" about their input data.

Of interest in this work are deep learning systems belonging to the second paradigm which are built to exploit data with a group-like structure. In this work, we provide an algebraic foundation for such “group equivariant neural networks", and use this foundation to examine their properties. Furthermore, we provide a theorem which gives an explicit method for creating such networks from the underlying structure of the group.