UNIVERSITY of GUELPH

COLLEGE of ENGINEERING AND PHYSICAL SCIENCES

SCHOOL OF COMPUTER SCIENCE

MSc Defence

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Temporal Fusion Transformers:
A Novel Approach to Streamflow Prediction

Chair: Dr. Fei Song
Advisor: Dr. Stefan Kremer
Advisory: Dr. Andrew Hamilton-Wright
Non-Advisory: Dr. Neil Bruce

Abstract:

Streamflow prediction has traditionally depended on physical-based models. However, recent developments in data-driven machine learning models present promising alternatives for hydrology. This thesis explores these approaches and introduces the Temporal Fusion Transformer model for streamflow prediction, which requires minimal input data and can adapt to various prediction scenarios.

To train this model, hydrological data from thousands of North American locations over several decades were combined with climate and land cover data. The model was incrementally developed to demonstrate the strengths of various data sources, hydrological modeling, and additional model enhancements. Initial results reveal the model's exceptional performance in hindcasting across diverse climates, as well as short-term forecasting capabilities when tested in Ontario.

However, challenges remain in forecasting ungauged locations and predicting streamflows beyond the short term due to uncertainties in weather forecasting data. Despite these limitations, this research highlights the potential of transformer models in hydrological applications and paves the way for further investigations into improving their predictive capabilities.