

An Integrated Framework for Near-Real-Time Flash Flood Forecasting through Automated Ground Information Extraction via Computer Vision and a Physics-Informed Spatio-Temporal Graph Neural Network

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Background

- Flash flood: **Rapid rise** of water within **3-6 hours** of heavy rainfall
- Dynamic, unpredictable and localised
- Needs prior information to mitigate the risk and for strategic planning
- Traditional approaches include:
 - Static Data – Cannot handle the dynamic nature
 - Inefficient data transfer mechanisms – Outdated data
 - Manual feature engineering – Inefficient data processing

Motivation

- Computer vision can extract up-to-date ground information from drone images
- But traditional models cannot integrate this data efficiently
- Traditional approaches are time-consuming and struggle to handle the dynamic nature

Study areas to date



- 70.21km² in the Crookstown area in the valley of the Bride River basin
- Recurrent flash flooding events, such as the storms of 2012 and 2015
- Steep topography and narrow valleys that accelerate runoff

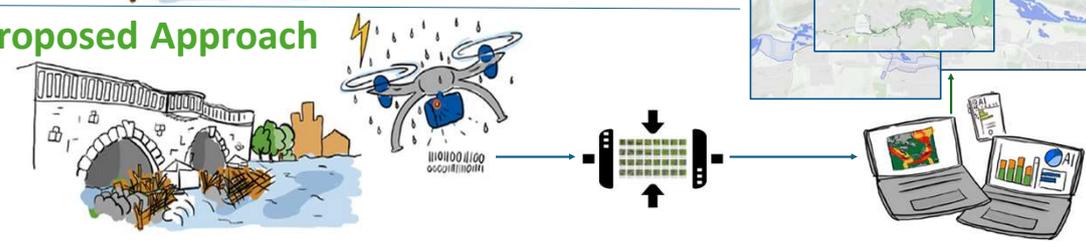
Traditional Approach



With traditional Hydrologic/ Hydraulic models:

- Longer execution time
- Cannot use drone data beyond model validation and boundary conditions

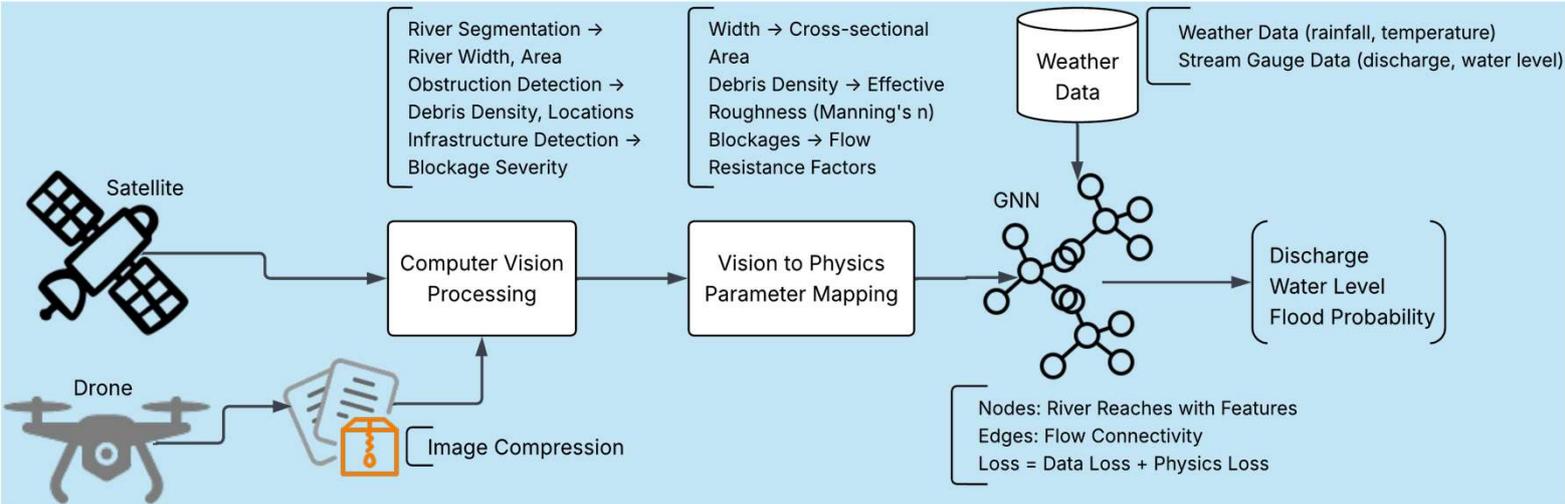
Proposed Approach



With Machine Learning based models:

- Can handle the dynamic nature
- Can perform simulations faster
- Can integrate heterogeneous data seamlessly

Methodology



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