

Improving Space-Time Image Velocimetry Accuracy with Deep Learning: Integrating Synthetic and Real-World Data

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1 Quantifying streamflow is essential for resource management, habitat
2 monitoring, and emergency response, but extreme events pose challenges for
3 direct measurements due to safety and accessibility concerns. Remote sensing
4 techniques, such as Space-Time Image Velocimetry (STIV), allow for non-
5 contact measurements of velocity and discharge. STIV uses video footage
6 of the water surface to generate Space-Time Images (STI), assuming surface
7 textures will act as passive tracers. However, environmental conditions such
8 as sunlight conditions, surface reflections or rain can hinder the quality of the
9 STIs. While Wavenumber–Frequency Spectra (WFS) filters can improve STI
10 quality, they struggle in real-time applications. Incorporating deep learning
11 can enhance real-time accuracy, as demonstrated in previous work with syn-
12 thetic STIs. We aim to extend this by combining synthetic, computational,
13 laboratory-controlled, and real-world data to improve the accuracy of flow
14 measurements in natural settings.