

MEMFOF: High-Resolution Training for Memory-Efficient Multi-Frame Optical Flow Estimation

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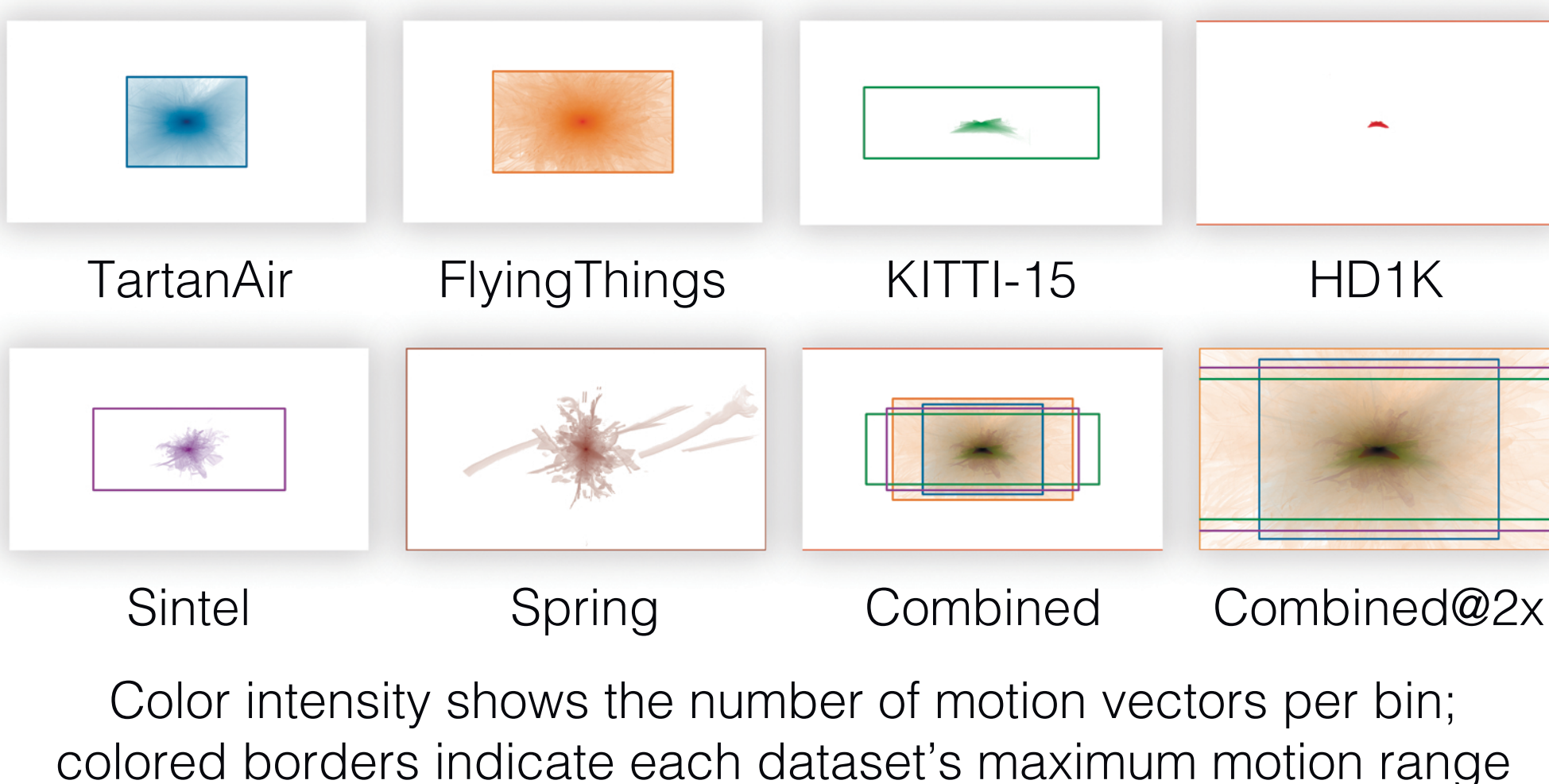
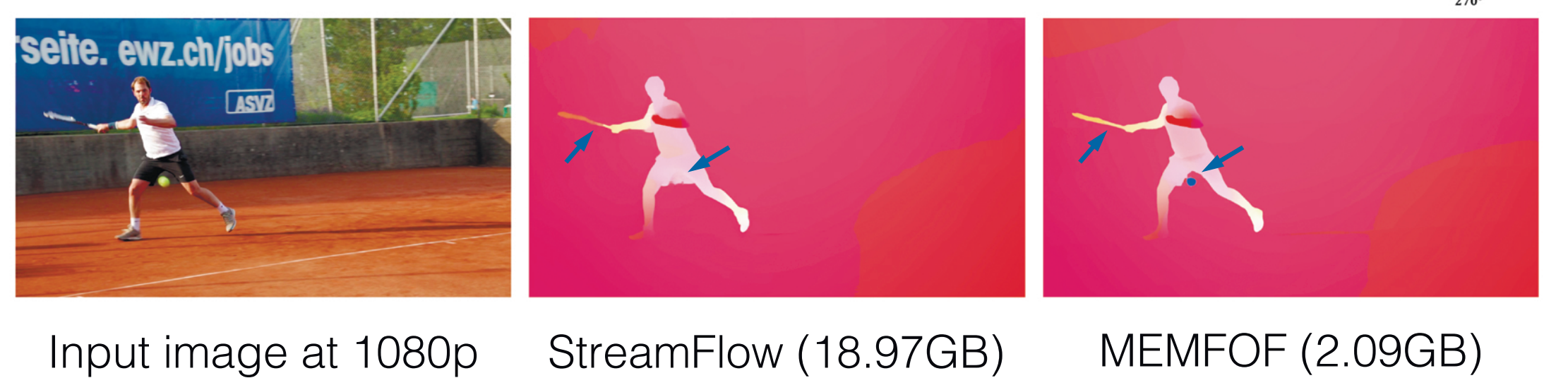
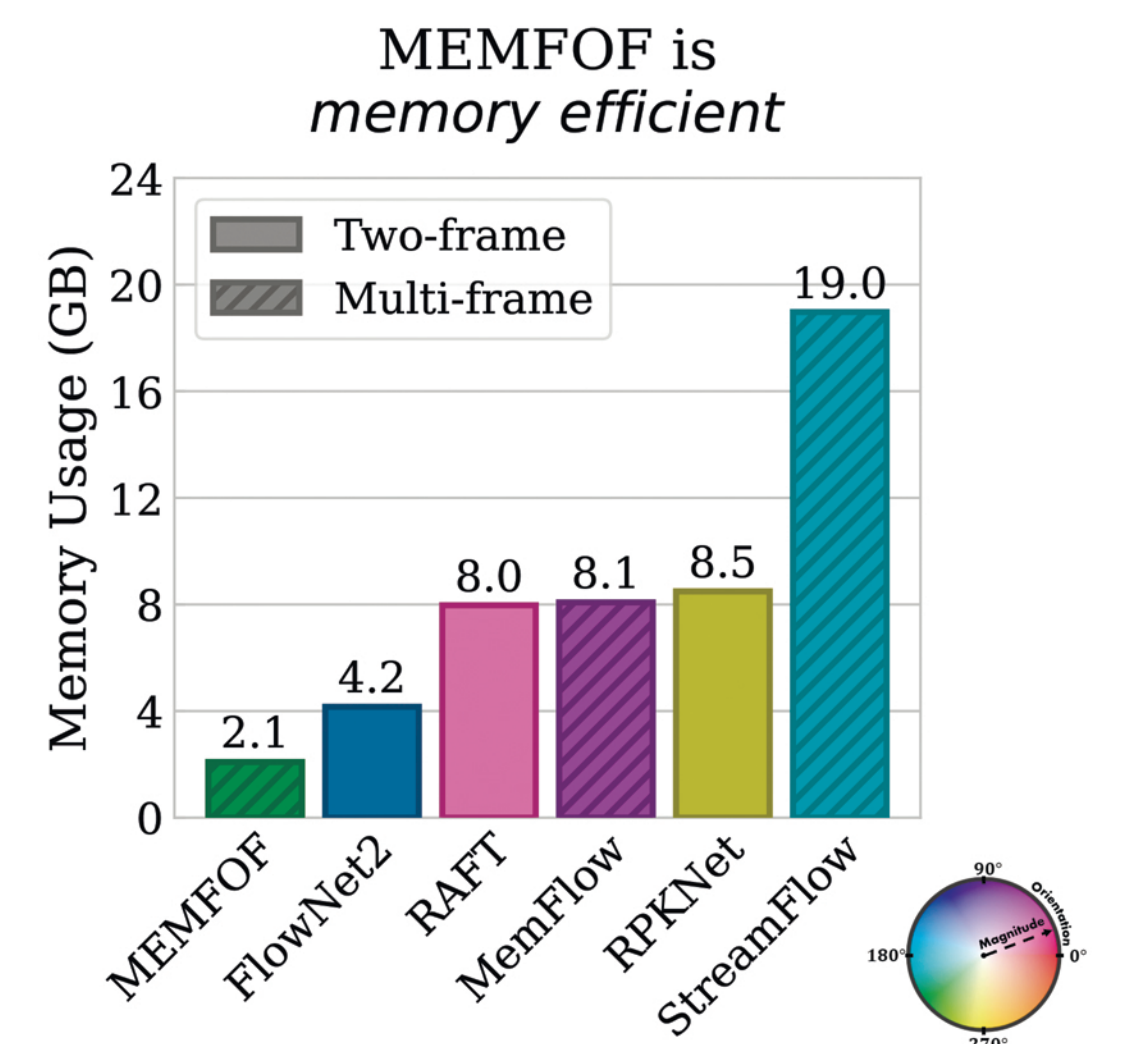
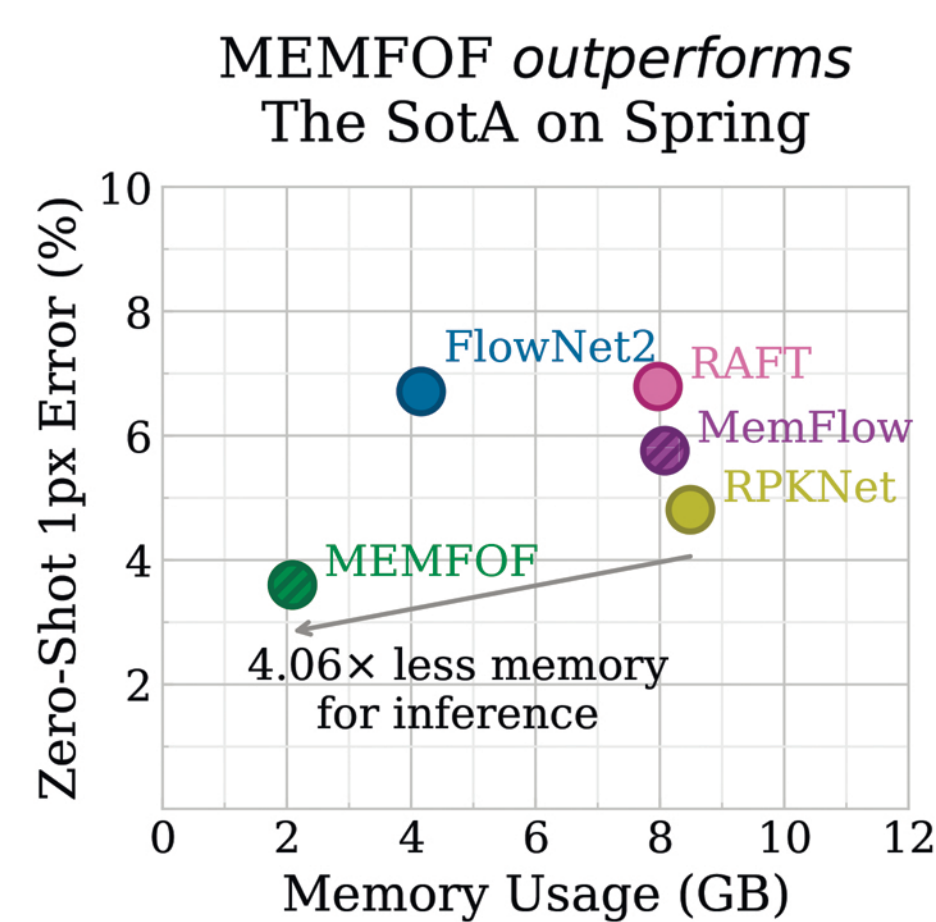
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Optical Flow Estimation

- Optical flow estimates the **motion of pixels** between consecutive video frames
- It is widely used in **video analysis**, **action recognition**, and **motion-based video processing**

Motivation & Key Results

- State-of-the-art optical flow models already deliver high-quality results but demand **excessive GPU memory**
- MEMFOF achieves **even higher quality** while enabling Full HD (1080p) flow estimation using **only 2.09 GB** of memory, allowing native processing without cropping, tiling, or downsampling

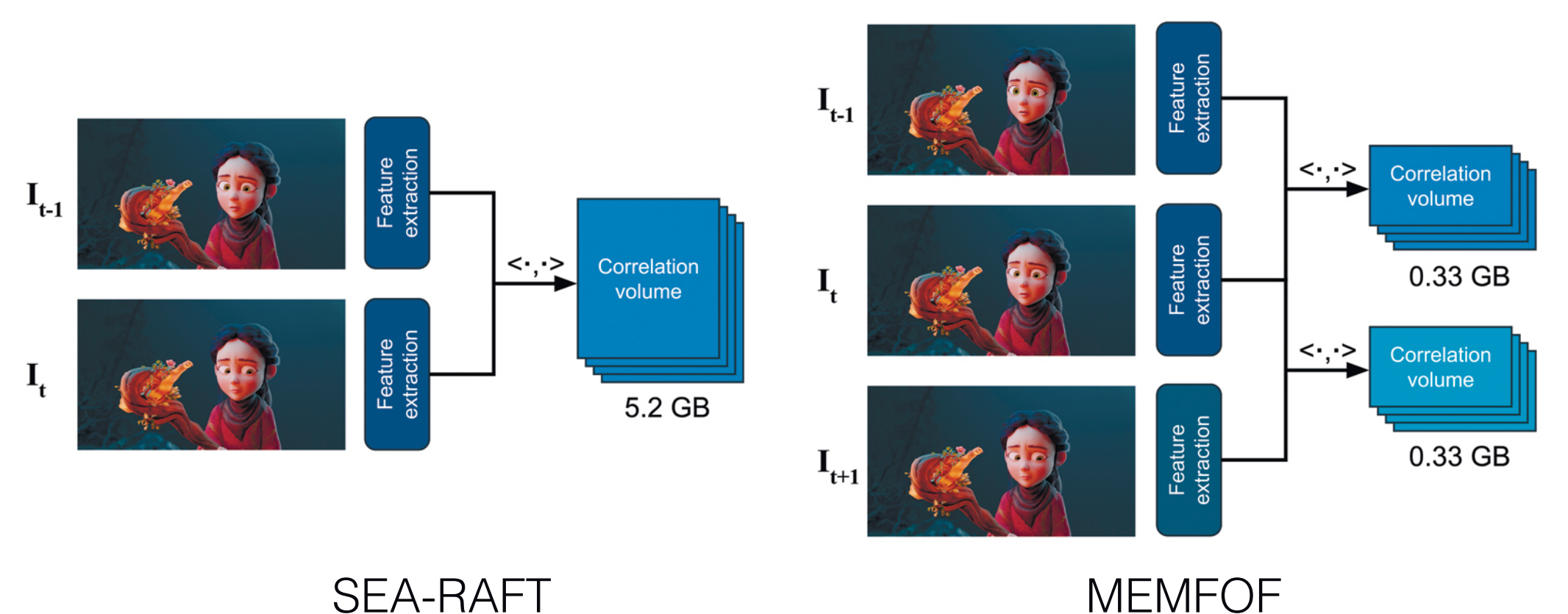


Training on High-Resolution Data

- We analyzed popular optical flow datasets using two-dimensional **motion histograms** to identify gaps in existing data — it turns out that the motion range of most datasets is very limited
- We then enhance our training set via 2x upsampling. This simple trick makes flow vectors more diverse and **reduces endpoint error by 26%** on the high-resolution Spring benchmark

Memory Efficiency and Multiple Frames

- Reducing the **correlation volume resolution (2x)** frees memory for multi-frame processing, which improves **temporal stability** and optical flow quality
- Even with **two correlation volumes**, our approach requires much less memory than many other RAFT-based methods, enabling native **Full HD** training and inference



Project page



GitHub

Conclusion

- We show that **Memory-Efficient Multi-Frame Optical Flow** is achievable without sacrificing accuracy
- We establish a **strong baseline** for future research on multi-frame correlation methods
- MEMFOF can be Integrated into your project in just **5 minutes**, check out our GitHub repository