Ultra-high-resolution unpaired stain transformation via Kernelized Instance Normalization

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Project website

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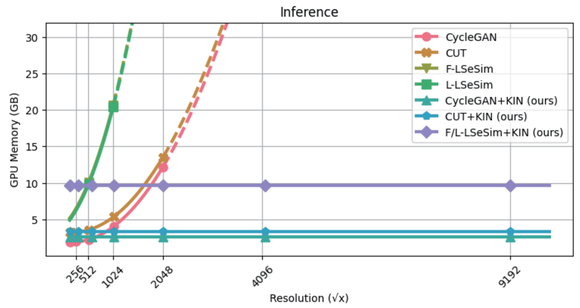
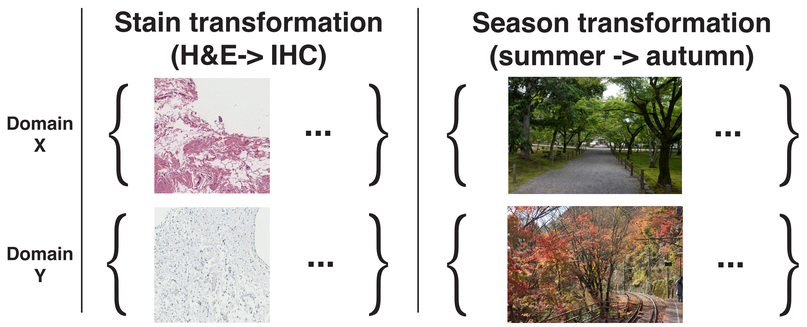
Summary

- This is the first successful study for the **ultra-high-resolution unpaired image-to-image translation** with **constant space complexity** (GPU memory).
- Without re-training the models, our KIN module can be seamlessly inserted into most currently developed image-to-image translation frameworks that have IN layers, such as CycleGAN, CUT, and LSeSim.
- With the KIN module, local contrast and hue information in translated images can be well preserved and tiling artifacts can be circumvented.



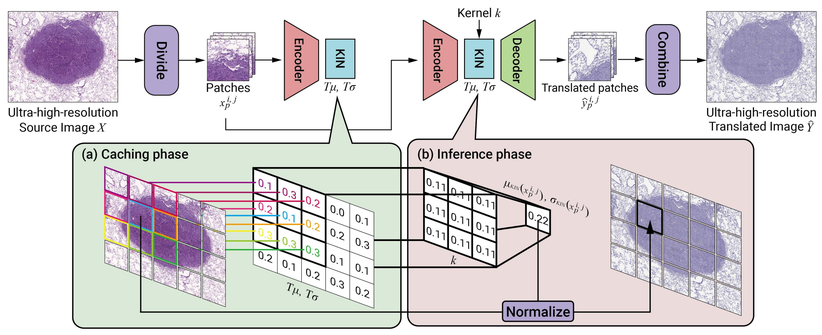
Unpaired Image-to-image translation



Goal: find a function $F: X \rightarrow Y$

Given unpaired staining images in domain X and Y, find a function F that can transform any instance x in domain X to Y.

Approach (Kernelized Instance Normalization)

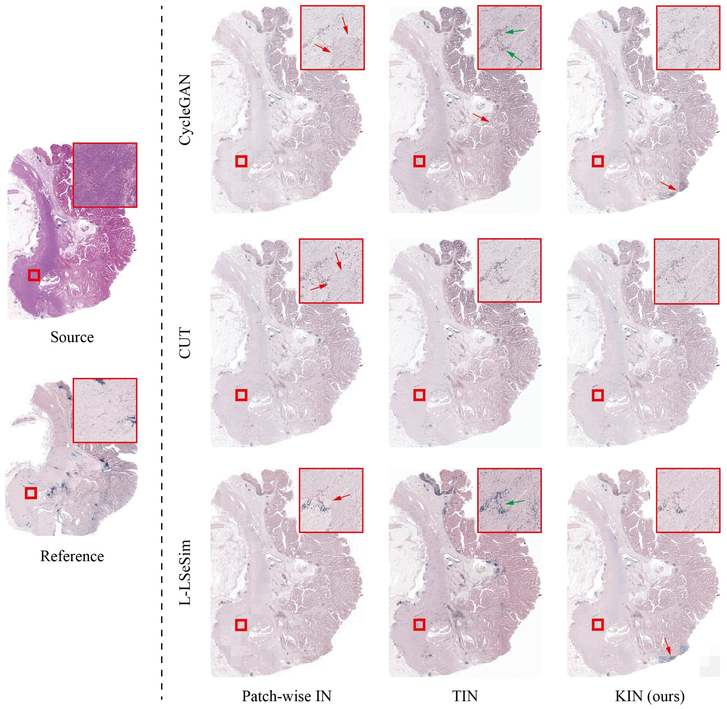


Inference process

1. Replace IN layers with KIN layers.
2. Input cropped images with their coordinates, cache the computed mean and variance values.
3. Use the mean and variance from the cache tables and conduct convolutional operation with defined kernel.
4. Conduct normalization with the above statistics.
5. Assemble output patches.

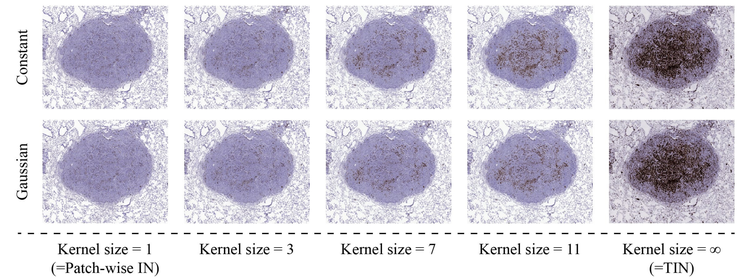
Experiments

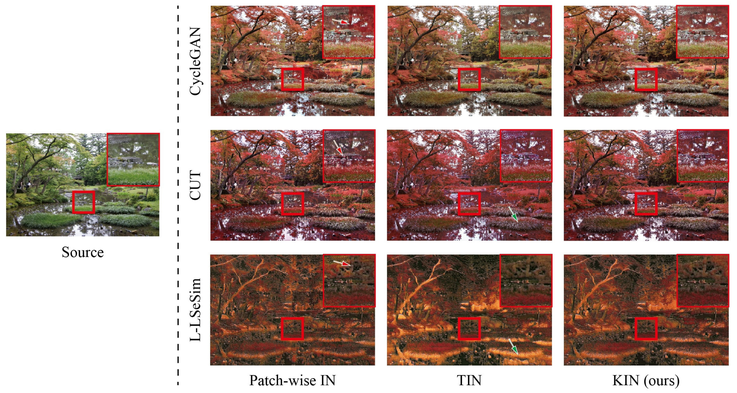
Qualitative results



9,816 × 8,433 pixels

Ablation study





3, 456 × 5, 184 pixels