

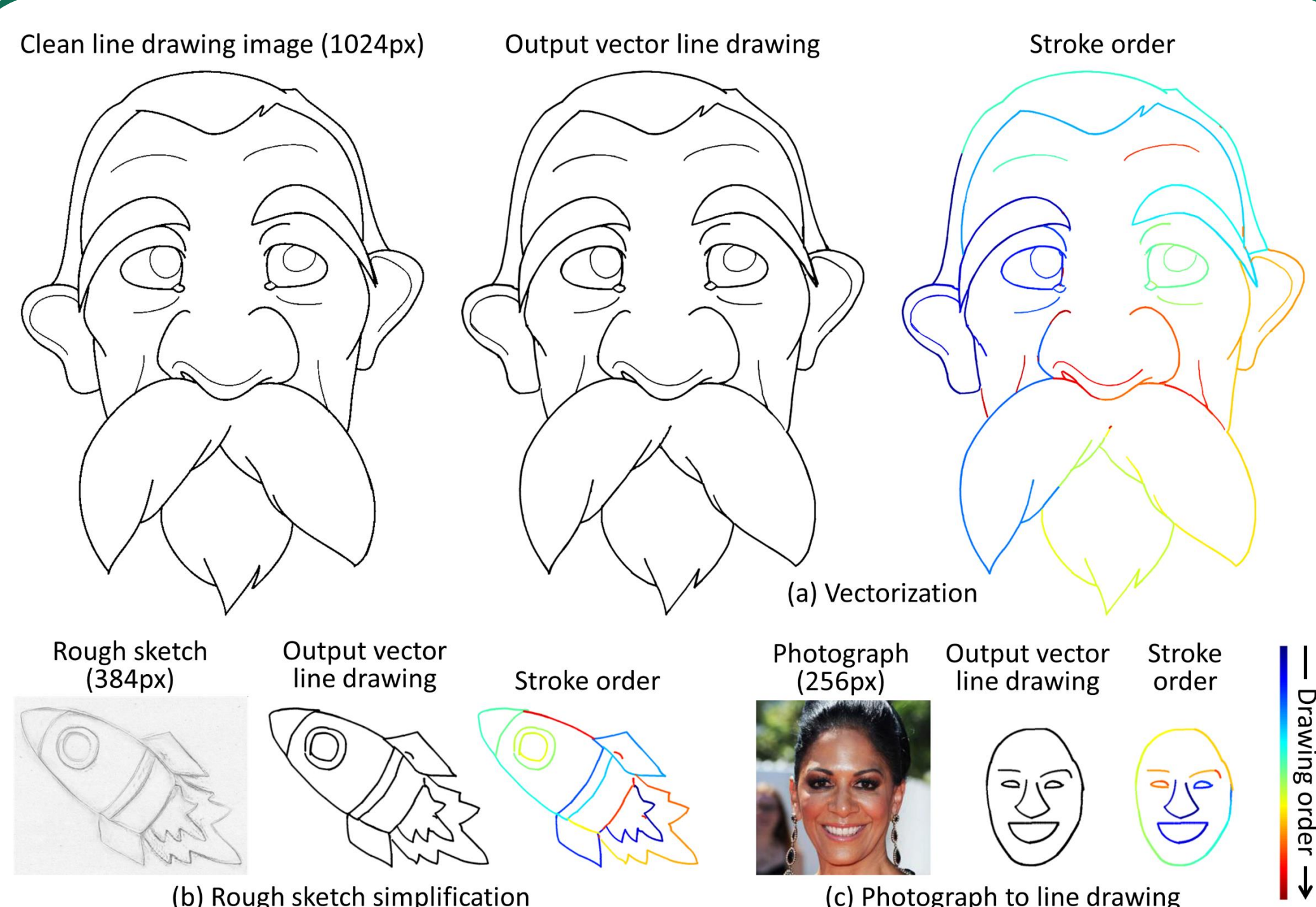


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Introduction



Background

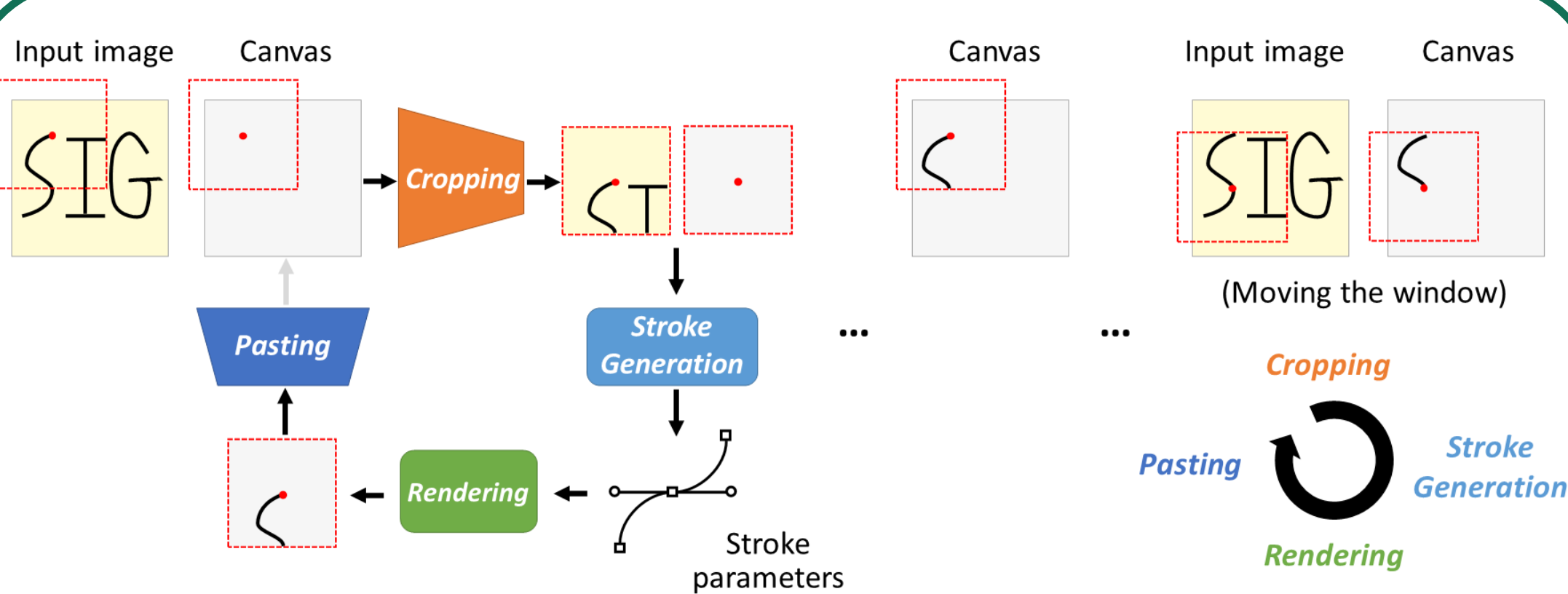
- Vector images are important to graphic design, 2D animation and 3D printing; allow flexible editing in comparison with raster images.
- But manually creating vector line art is costly.

Contributions

- A general framework for **vector line drawing generation** that works with a **wide variety of images**; not requiring vector images for training.
- Model a virtual pen using a dynamic window while drawing lines; allows processing images of **arbitrary resolution**.
- Stroke regularization mechanism that controls the **simplicity** of the output vector images.

https://github.com/MarkMoHR/virtual_sketching

Method



Raster Input and Vector Output

- Learns a raster image to vector stroke parameters mapping directly.
- Dependent only on **raster** training data because of a **differentiable rendering** module.

Dynamic Window Mechanism

- To work on **arbitrary resolution**, we propose modeling a virtual pen using a dynamic window, which draws stroke on the canvas.
- Using aligned cropping and differentiable pasting.

Four Main Modules

- Cropping**: patches from input image and canvas are cropped based on the window.
- Stroke Generation**: based on the patches, the stroke generator produces the vector parameters.
- Rendering**: stroke parameters are approximated into a stroke image by differentiable rendering.
- Pasting**: the stroke image is pasted to the last canvas based on the window.

Recurrent Drawing

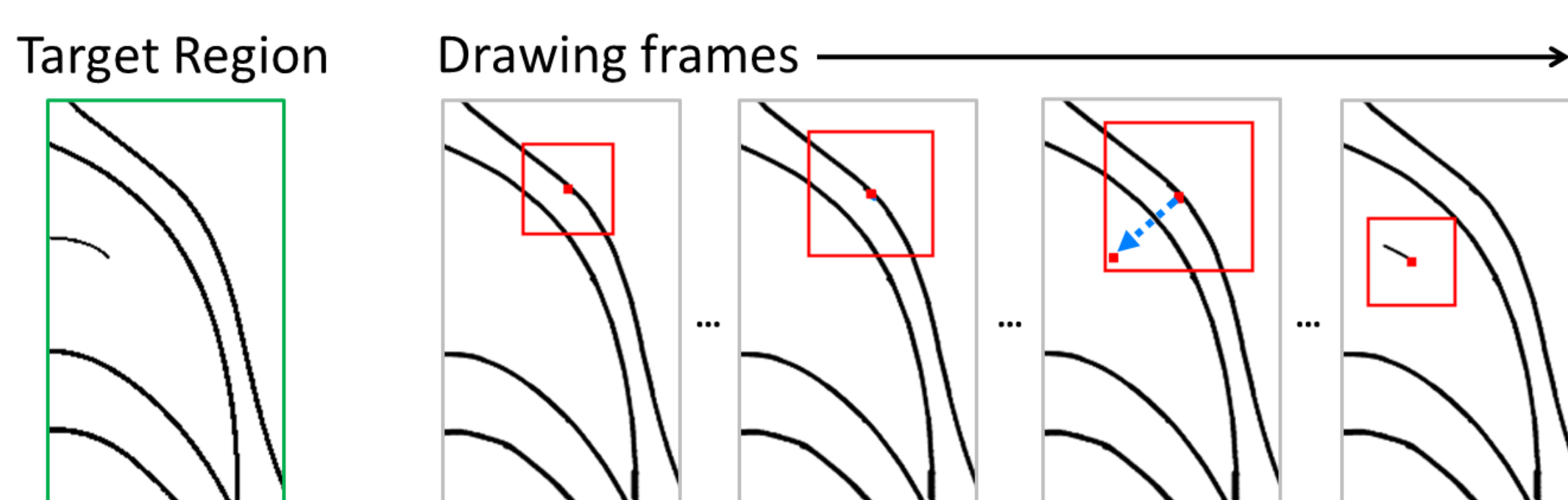
- Draws the next stroke based on the previous canvas in a recurrent manner.

References

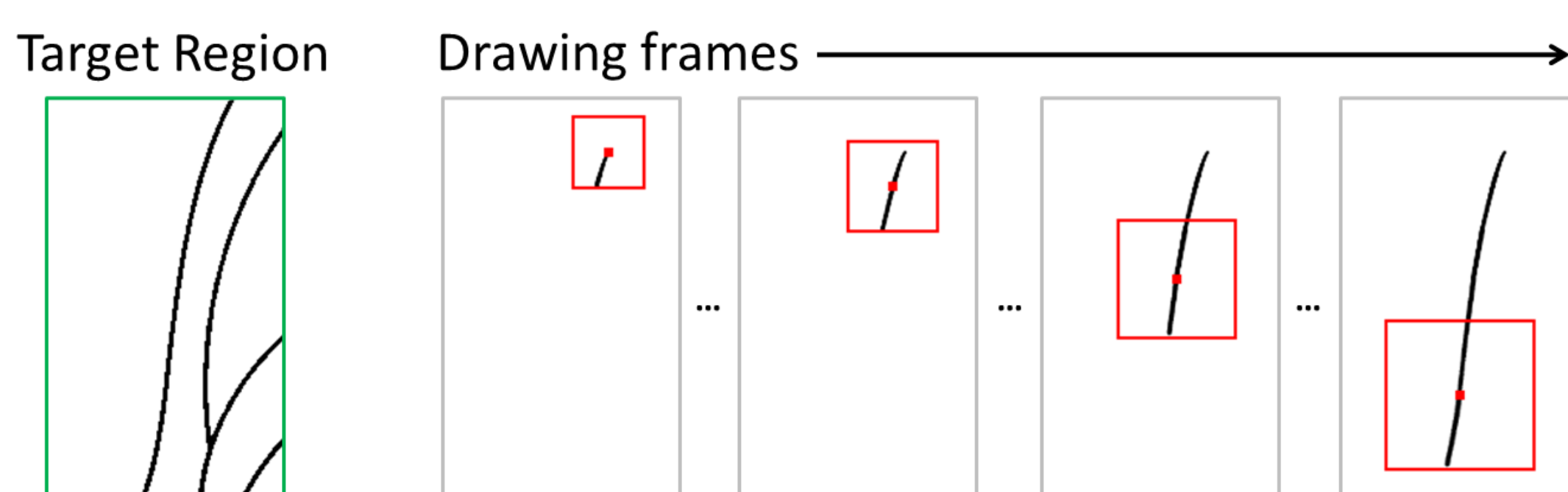
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- [4] Zhewei Huang, Wen Heng, and Shuchang Zhou. Learning to paint with modelbased deep reinforcement learning. ICCV 2019.
- [5] Mengtian Li, Zhe Lin, Radomir Mech, Ersin Yumer, and Deva Ramanan. Photosketching: Inferring contour drawings from images. WACV 2019.

Results

Basic Functions

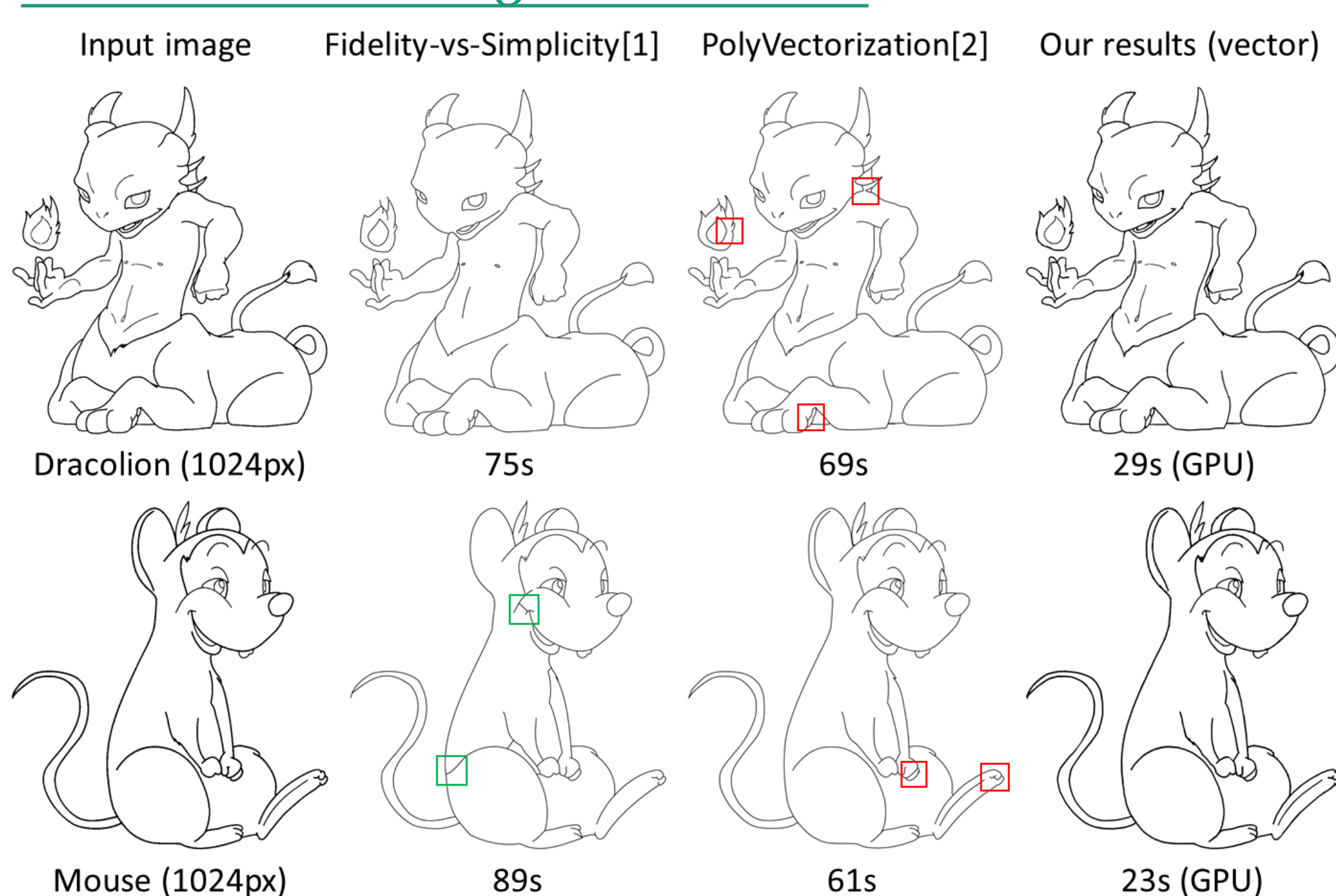


- Moves around by scaling the window and sliding to an undrawn area for restarting the drawing.



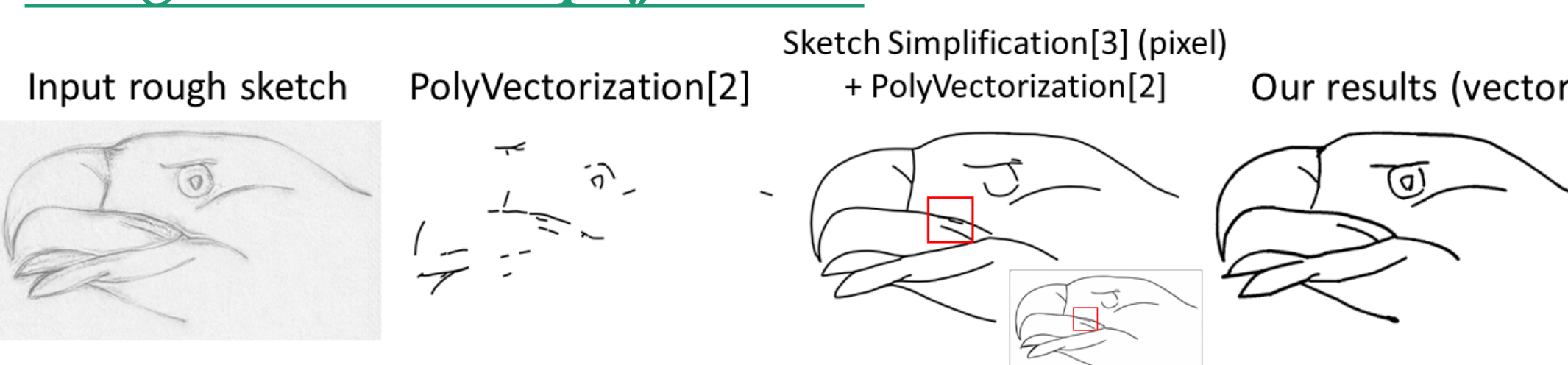
- Able to enlarge the window and draw long strokes for simplicity (stroke regularization mechanism).

Clean Line Drawing Vectorization



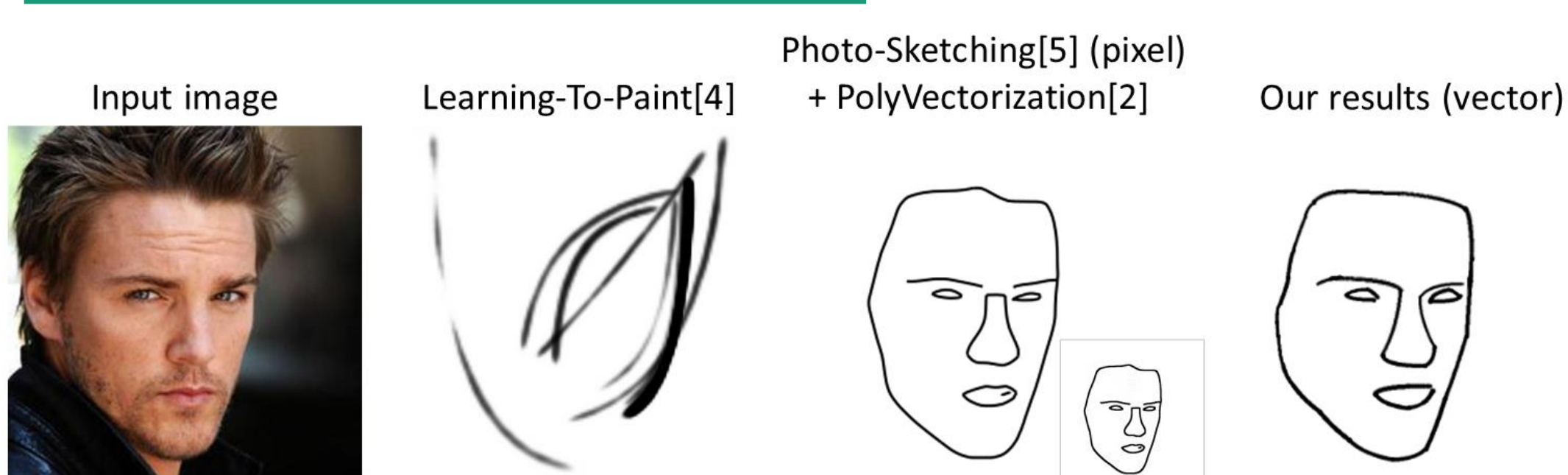
- Our model works better on both completeness and details in less computation time.

Rough Sketch Simplification



- Our model produces comparable simplified results of vector format in a single step.

Photograph to Line Drawing



- Our model generates comparable facial sketches.

Limitations and Discussion

- “missing lines” in some highly complicated cases
 - ✓ alternative encoding methods (e.g., pyramid views) with the global guidance
- Difficult to generalize well on complex rough sketches or photographs and may produce artifacts
 - ✓ combining the pixel-level models and our approach in a single end-to-end model
- Perform less than satisfactory in some types of junctions (*not intended for recovery of topology*)
 - ✓ pre-defined principles as prior or constraint information can be incorporated

