Parallel Multi-Resolution Fusion Network for Image Inpainting

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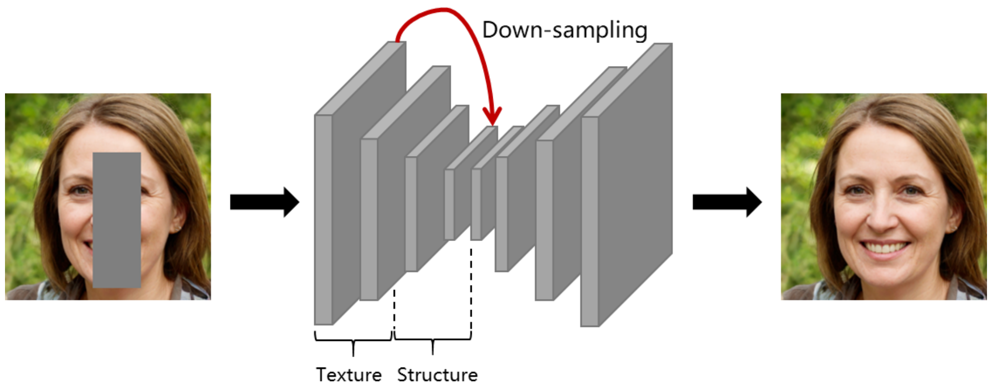
Challenges

- **Issue 1.** Most deep image inpainting methods are based on auto-encoder architecture, in which the spatial details of images will be lost in the down-sampling process.



Auto-encoder based inpainting methods

Qualitative comparison on Paris Street View

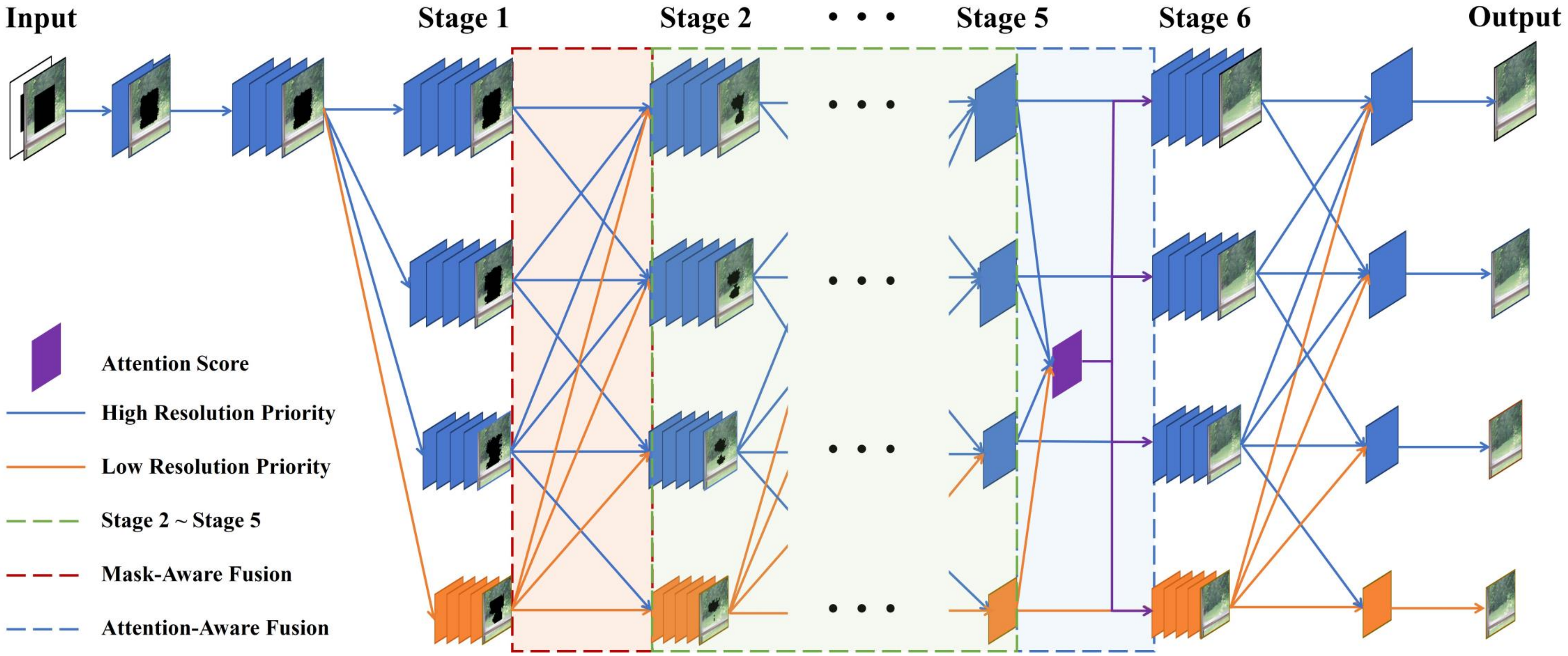
- **Issue 2.** Texture information and structure information can not be well integrated into a serial inpainting network like auto-encoder.

Our Solutions

- For **Issue 1.**
  - Parallel multi-resolution architecture always maintains high resolution representation.
- For **Issue 2.**
  - Multiple multi-resolution feature fusions make a better integration of structure and texture.
  - Two fusion methods:
    - Mask-aware representation fusion.
    - Attention-guided representation fusion.

Proposed Method

- Parallel Multi-Resolution Inpainting Network



Proposed Method

- Inpainting Priority

Step 1: Mask update

$$m' = \begin{cases} 1, & if \ \mathrm{sum}(\boldsymbol{M_p}) > 0 \\ 0, & otherwise \end{cases}$$

Step 2: Feature update

$$x_p = \begin{cases} \frac{\Omega_p}{sum(M_p)} W \cdot (X_p \odot M_p) + b, & if \ m' = 1 \\ 0, & otherwise \end{cases}$$

Partial Conv[1]

[1] Liu et al., Image inpainting for irregular holes using partial convolutions, ECCV'18

Step 1: Mask update

$$m' = \begin{cases} 1, & if \ m = 1 \ or \ q \geq \delta \cdot q^{max} \\ 0, & otherwise \end{cases}$$

The calculate of the pixel x priority q:

$$\mathrm{q} = \mathrm{sum}(\boldsymbol{M_p}) \cdot \rho^l(\mathrm{x})$$

Common priority term : $\mathrm{sum}(\boldsymbol{M_p})$

Low-resolution priority ($l = 0$):

$$\rho^l(x) = |n_p \cdot \nabla X_p^{\perp}|$$

High-resolution priority ($l = 1,2,3$):

$$\rho^l(x) = |n_p \cdot \nabla(X_p - X_{p\uparrow\downarrow})|$$

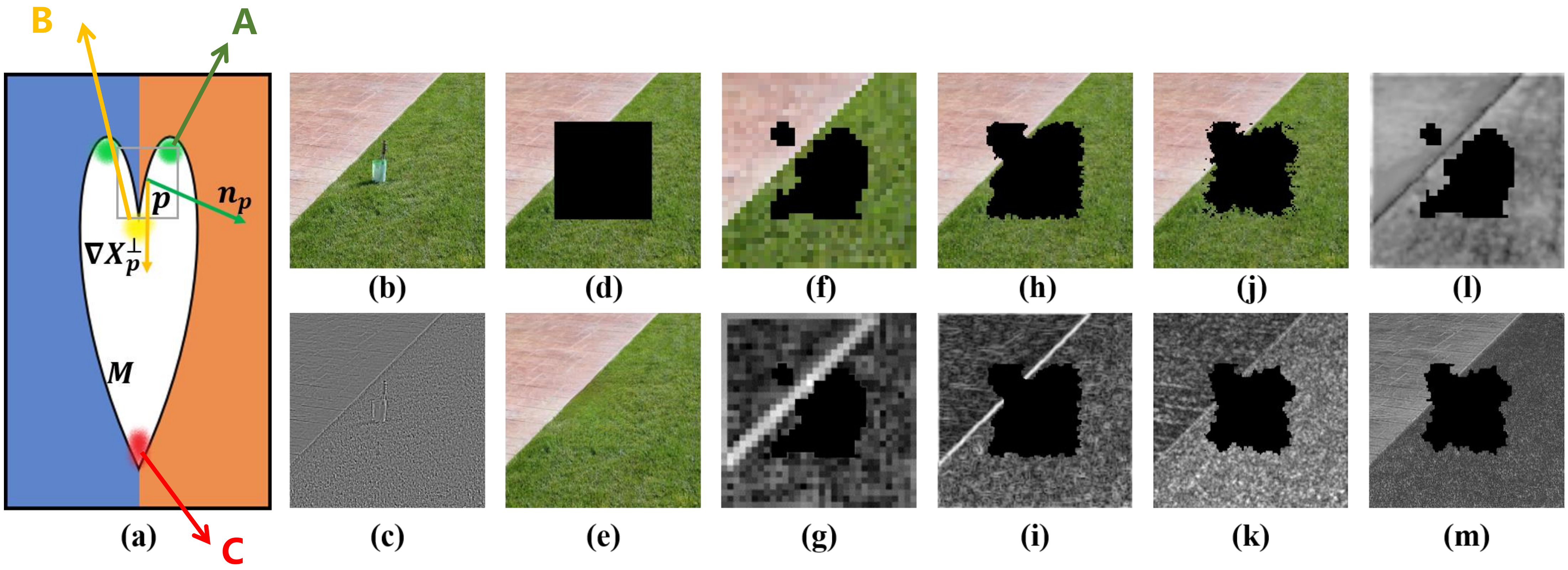
Step 2: Feature update

$$x_p = \begin{cases} \frac{\Omega_p}{sum(M_p)} W \cdot (X_p \odot M_p) + b, & if \ m' = 1 \\ 0, & otherwise \end{cases}$$

Ours

Proposed Method

- Inpainting Priority



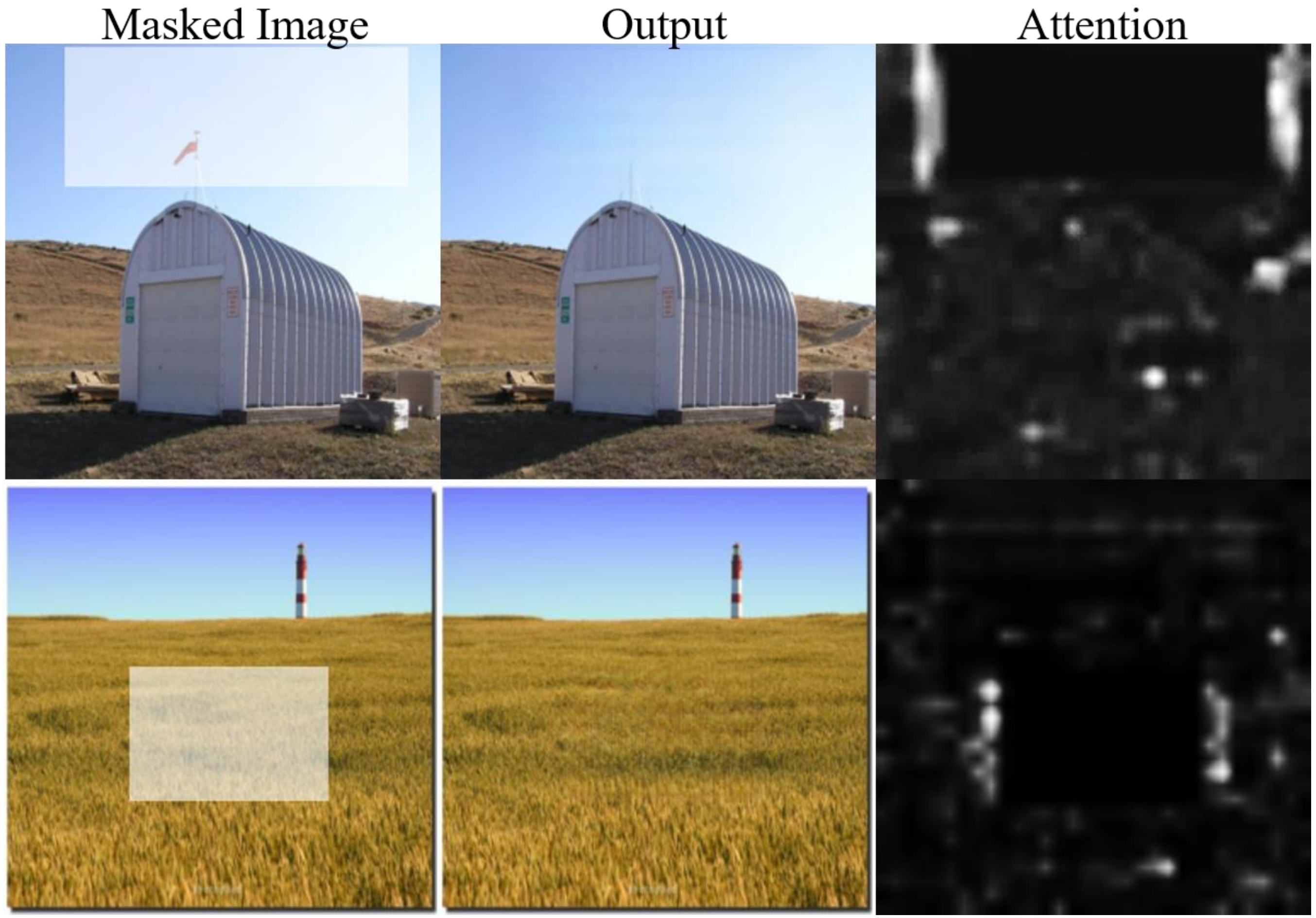
A: High common priority but low contour striking priority.

B: High contour striking priority but low common priority.

C: Both high common priority and high contour striking priority.

Proposed Method

- Attention-Guided Representation Fusion



Masked region attends relevant information from unmasked region. E.g., wheat land (resp.,sky) for wheat land (resp., sky).

Experimental Results

- Qualitative comparison on Places2

(a) Masked Image (b) GC (c) EC (d) SF (e) HF (f) MEDFE (g) Ours (h) Ground Truth

Thanks for watching!

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