A Simple Plugin for Transforming Images to Arbitrary Scales

Qinye Zhou*, Ziyi Li*, Weidi Xie, Xiaoyun Zhang, Yanfeng Wang, Ya Zhang

* Indicates equal contribution

Shanghai Jiao Tong University

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Why We Design a Plugin for Transforming Images to Arbitrary Scales?

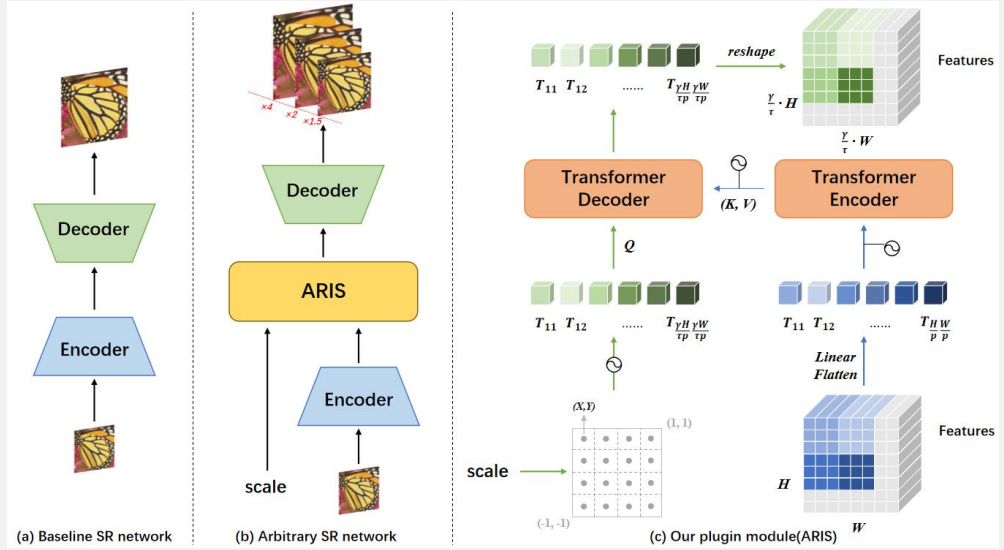
- Most image super-resolution (SR) methods are **specialized for one scale**, i.e., different models should be trained for different scales, **limiting practical use** in real-world applications.
- *Why do not we use **a single model for arbitrary-scale super-resolution**?*
- Existing works on arbitrary-scale super-resolution are achieved by a specific network, ignoring the existing powerful SR methods specialized for one scale.
- *Why do not we use **a simple plugin** to **augment** the ability of powerful SR methods specialized for one scale **towards Arbitrary Resolution Image Scaling** and **maintain** their original well performance on fixed scale factor?*

Our Contribution:

- We propose a **transformer-based plugin** module, called **ARIS**, which resembles an implicit representation for images and can be inserted into any existing super-resolution models, conveniently **augmenting** their ability to upsample the image with **arbitrary scale**;
- We introduce a **novel self-supervised training scheme**, that exploits consistency constraints to **train** our ARIS plugin module **towards out-of-distribution scales**, i.e., LR-HR image pairs are unavailable;
- The ARIS plugin module is orthogonal to the development of new super-resolution architectures, we insert it into several strong models published recently, the resulting models **outperform the any-scale super-resolution models** on various benchmarks

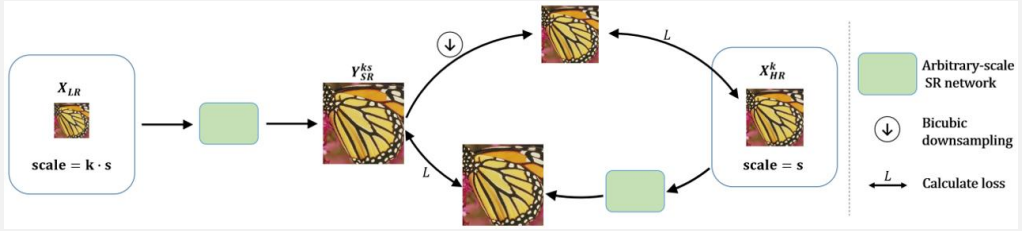
Project page: **https://lipurple.github.io/ARIS_Webpage/**

Simple Plugin for Arbitrary Resolution Image Scaling (ARIS)



- Our proposed ARIS plugin can be inserted into any existing baseline SR network (a), to obtain arbitrary-scale SR network (b) , conveniently augmenting the baseline SR models' ability towards **Arbitrary Resolution Image Scaling**.
- The transformer-based ARIS plugin, which uses spatial coordinates as query, iteratively attend the low-resolution image feature through cross-attention, and output visual feature for the queried spatial location, **resembling an implicit representation for images.**

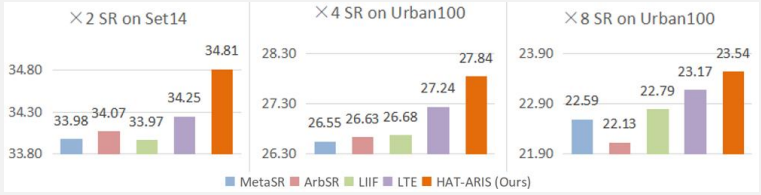
Self-supervised Training Strategy with Consistency Constraints



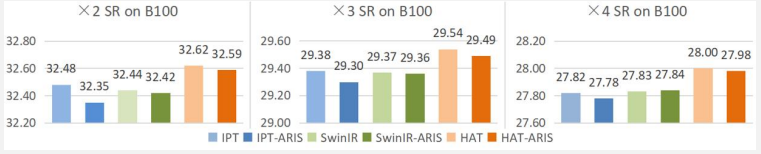
For training the model on out-of-distribution scales beyond the resolution limitation, we adopt a self-supervised training scheme that exploits consistency constraints, which consists of

- **down-consistency training**: downsample the SR image to the same resolution as available HR image
- **up-consistency training**: upsample the HR image to the same resolution as the SR image

Experimental Results



HAT-ARIS **outperforms all** existing arbitrary-scale SR models, **for both in and out-distribution scales**, validating the effectiveness of ARIS.



The IPT-ARIS, SwinIR-ARIS, and HAT-ARIS achieve **comparable performance** to their corresponding baseline networks on in-distribution scale factors.