User Guide

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Let us explain how to use SSSS algorithm for Sentinel-2 super-resolution. *Notations:* $\boldsymbol{K}_j$ is a $j \times j$ zero matrix with the $(1,1)$th entry replaced by 1; $\otimes$ is Kronecker product.

1. Given a real Sentinel-2 image with the dimension of 10m band being $C \times D$, remove the band that records only the cirrus information (usually, B10), resulting in a 12-band image:

   - For those 20m bands $\boldsymbol{Y}_i$, insert zeros to get $\boldsymbol{Y}_i \otimes \boldsymbol{K}_2$, whose dimension becomes $C \times D$.
   - For those 60m bands $\boldsymbol{Y}_i$, insert zeros to get $\boldsymbol{Y}_i \otimes \boldsymbol{K}_6$, whose dimension becomes $C \times D$.
   - Note that both C and D should be multiples of 6.

   So, the Sentinel-2 data are formalized as a tensor of dimension $C \times D \times 12$.

2. If the spatial dimension $C \times D$ is very large, we explain how to divide it into *overlapping* subimages, and how to merge the super-resolved subimages.

   - If a blurring kernel with 13×13 support is considered, border pixels in the first/last $6 = \frac{13-1}{2}$ columns/rows (of the super-resolved subimage) should be removed, as the blurring is BCCB.
   - Therefore, the dimension C and D should also satisfy

   $$C - 12 = (n_r - 12)A, \tag{1}$$
   $$D - 12 = (n_c - 12)B, \tag{2}$$

     for some positive integers A, B; in other words, the $C \times D$ image are divided into $A \times B$ *overlapping* blocks/subimages (each subimage is of size $n_r \times n_c$.)
   - (Remark) n_r, n_c should also be multiples of 6.
   - In our demo, $(C, D) = (432, 108)$, so we choose (n_r, n_c) as $(n_r, n_c) = (72, 108)$, which satisfies Equation (1)-(2) with $(A, B) = (7, 1)$.
   - In other words, the vertical dimension is divided into 7 *overlapping* blocks/subimages in our demo, while the horizontal dimension is not divided. As mentioned above, border pixels of the super-resolved subimages are removed before they are merged.

   Implementation of the dividing/merging processes are demonstrated in the "demo.m" file.

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