Appendix of "Disentangling Light Fields for Super-Resolution and Disparity Estimation"

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In this Appendix, we present the details of the SAI-MacPI conversion, i.e., the LF reshape operation. We use the notations in Table 1 for formulation. As shown in Fig. 1, an LF $\mathcal{L} \in \mathbb{R}^{U\times V\times H\times W}$ can be organized into a macro-pixel image (MacPI) $\mathcal{I}_{MacPI} \in \mathbb{R}^{UH\times VW}$ or an array of sub-aperture images (SAIs) $\mathcal{I}_{SAIs} \in \mathbb{R}^{UH\times VW}$. The LF reshape operation is defined as the transformation between these two representations. To convert LFs from one representation to the other representation, the one-to-one mapping function between MacPI and SAIs needs to be built. Without loss of generality, we take spatial-to-angular reshape as an example, namely, to find point $(\xi,\eta) \in \mathcal{I}_{MacPI}$ corresponding to a known point $(x,y) \in \mathcal{I}_{SAIs}$. We first calculate the angular coordinates u and v of point (x,y) according to

$$u = \lceil x/H \rceil = \lfloor x/H \rfloor + 1, \tag{1}$$

$$v = \lceil y/W \rceil = \lfloor y/W \rfloor + 1. \tag{2}$$

Using the angular coordinates, the spatial coordinates h and w can be derived by

$$h = x - (u-1)\,H = x - \lfloor x/H \rfloor H, \tag{3}$$

$$w = y - (v-1)\,W = y - \lfloor y/W \rfloor W. \tag{4}$$

Since $\mathcal{I}_{SAIs}$ and $\mathcal{I}_{MacPI}$ represent the same LF, (x,y) and (ξ,η) in these two representations have the same spatial and angular coordinates. Therefore, we find (ξ,η) corresponding to (u,v,h,w) as follows:

$$\begin{aligned}\xi &= U\,(h-1) + u\\ &= U\,(x - \lfloor x/H \rfloor H - 1) + \lfloor x/H \rfloor + 1\\ &= U\,(x-1) + \lfloor x/H \rfloor\,(1-UH) + 1,\end{aligned} \tag{5}$$

$$\begin{aligned}\eta &= V\,(w-1) + v\\ &= V\,(y - \lfloor y/W \rfloor W - 1) + \lfloor y/W \rfloor + 1\\ &= V\,(y-1) + \lfloor y/W \rfloor\,(1-VW) + 1.\end{aligned} \tag{6}$$

The angular-to-spatial reshape can be derived following a similar approach:

$$\begin{aligned}x &= H\,(u-1) + h\\ &= H\,(\xi-1) + \lfloor \xi/U \rfloor\,(1-UH) + 1,\end{aligned} \tag{7}$$

$$\begin{aligned}y &= W\,(v-1) + w\\ &= W\,(\eta-1) + \lfloor \eta/V \rfloor\,(1-VW) + 1.\end{aligned} \tag{8}$$

TABLE 1: Notations used in the appendix.

Notation	Representation
$\mathcal{L} \in \mathbb{R}^{U\times V\times H\times W}$	a 4D LF
$\mathcal{I}_{SAIs} \in \mathbb{R}^{UH\times VW}$	a 2D SAI array
$\mathcal{I}_{MacPI} \in \mathbb{R}^{UH\times VW}$	a 2D MacPI
$U, V \in \mathbb{Z}_+$	angular size
$H, W \in \mathbb{Z}_+$	spatial size
$u, v \in \mathbb{Z}_+$	angular coordinate
$h, w \in \mathbb{Z}_+$	spatial coordinate
$(x, y) \in \mathbb{Z}_+^2$	coordinate in $\mathcal{I}_{SAIs}$
$(\xi, \eta) \in \mathbb{Z}_+^2$	coordinate in $\mathcal{I}_{MacPI}$
$\lfloor\cdot\rfloor$	round-down operation

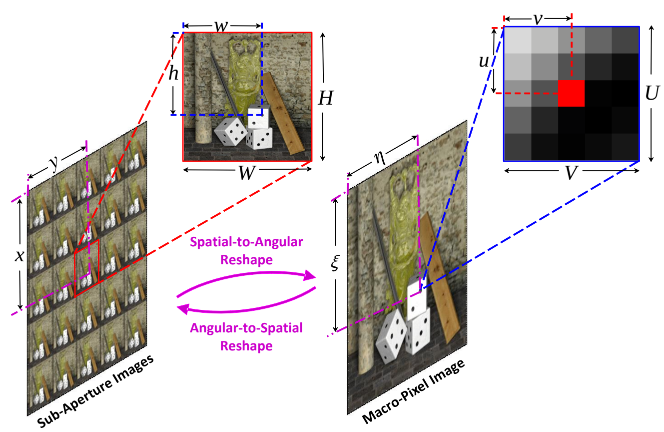

Fig. 1: An illustration of the LF reshape operation. Since the SAIs and the MacPI represent the same LF, the objective of LF reshape is to re-organize LFs between these two representations.