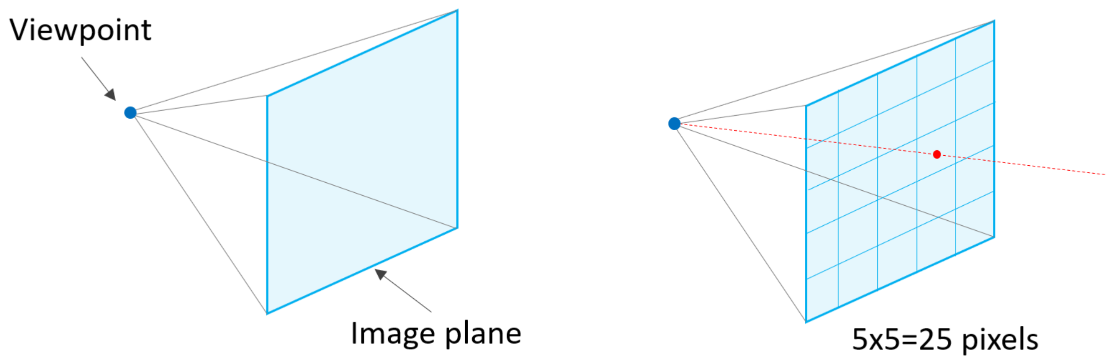
Supplementary Material to Assignment 2

1. Explanation to Camera Model

The specification document of assignment 2 and tutorial note 3 would be enough for you to complete this assignment. Anyhow, the key to understanding the implementation algorithm is the camera model, which consists of a viewpoint, an image plane, as Fig.1 (a) shows. The viewpoint is associated with a 3D coordinate $P(X, Y, Z)$,, and the image plane has a fixed range, i.e. $35\text{mm} \times$,35mm.



(a) Camera model (b) Image resolution

Fig. 1. Illustration of camera model

Then, there are several related parameters of this camera model: the distance between the viewpoint to the image plane is called "*focal length*"; The pixel grid setting on image plane is called "*image resolution*", for example, the image captured by the camera in Fig.1 (b) has a resolution of 5×5. As regulated in the assignment, any target view to be synthesized have a fixed image resolution, i.e. 512×512. Besides, in an image, each pixel records the radiance (i.e. the pixel value) of a light ray that passes through the pixel center (red dot in Fig.1 (b)) and the viewpoint. So, to synthesize an image of target viewpoint, we only need to calculate the values of each pixel located on the image plane, which can be interpolated from the light field recorded light rays.

2. A Fast Implementation to Basic Requirement

If you really find it difficult to implement the algorithm, here offers a fast implementation solution to basic requirement, which equals to an image interpolation problem. Note that, this solution is only feasible to basic requirement. For the full algorithm that supports enhanced features, you still need to follow the implementation steps provided in the specification.

a) Given a new viewpoint coordinate $P(X, Y, 0)$, we first find its four neighbor viewpoints on the view plane. Let them be P_1, P_2, P_3 and P_4, whose location layout is shown in Fig. 2.

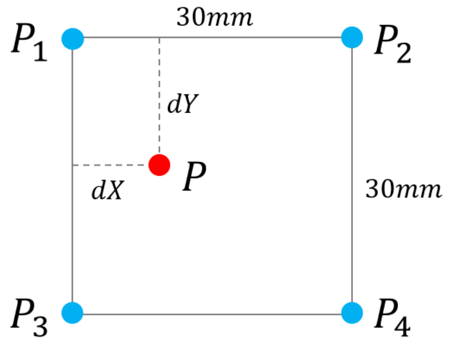


Fig. 2. Viewpoint layout example on the view plane

b) Based on the layout in Fig. 2, we calculate the interpolation coefficient: $\alpha = \frac{dX}{30}, \beta = \frac{dY}{30}$.

c) Each viewpoint is associated with an image, and the images of P_1, P_2, P_3 and P_4 are known (by read from bmp images) while the image of P remains to be computed. We can interpolate each pixel of P from the corresponding 4 pixels of P_1, P_2, P_3 and P_4 via bilinear interpolation based on the fixed coefficient α and β. Executing such interpolation for all the $512 \times ,512$ pixels on the target view, then we get the synthesized image of the target viewpoint.
<bilinear interpolation formula: see Tutorial note 3 -page15>