# EE702: Lec-9 (7 Feb)

1] Geometric constraints

a. Epipolar constraint
b. disp $(x,y) \geq 0 \;\forall\; (x,y)$
c. Left-to-right ordering is maintained in L & R.

2] Photometric constant

a) Image brightness at a point does not change between L and R.

3] Assumptions

a) $d_{MAX}$ is known.
b) $d(x,y)$
↳ smoothly varying

$\min \iint d_x^2 + d_y^2 = 0$

For trivial sol^ns ("Null space")
if $d_x = 0$, object is a 2-D shape
[$\min(\nabla^2 d)^2$ for trivial, a ramp is obtained for $\nabla^2 d = 0$]

If $x_{L(a)} < x_{L(b)}$ (opacity)

then $\longrightarrow \underbrace{d_a + x_{L(a)}}_{x_{R(a)}} \leq \underbrace{d_b + x_{L(b)}}_{x_{R(b)}}$

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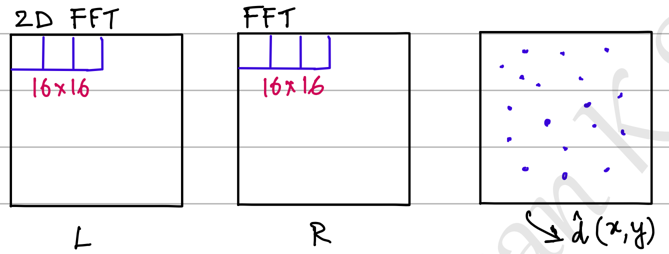
1]



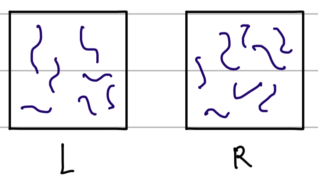

$g(x,y) \downarrow$ DFT

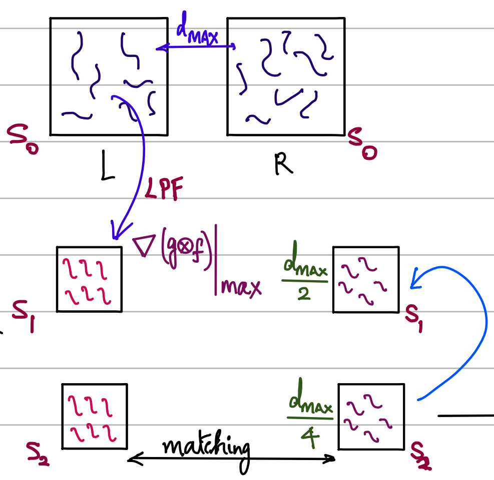
$g(x+d,y) \downarrow$ DFT

"Phase Shift"

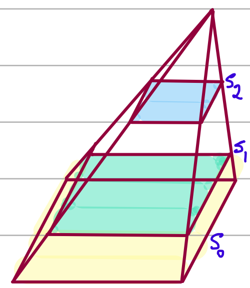
2] Point-wise matching

a)

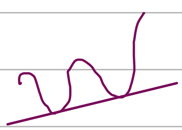



→ find $d_2(x,y)$




$d(x,y)$ aliasing



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3] Variational Approach

$$\min_{x,y} \iint \underbrace{\left[ \left[E_R(x+d(x,y), y) - E_L(x,y)\right]^2 + \lambda \underbrace{\left(d_x^2(x,y) + d_y^2(x,y)\right)}_{\text{Smoothness term}} \right]}_{F} dx\, dy = 0$$

$$F_d - \frac{\partial}{\partial x} F_{d_x} - \frac{\partial}{\partial y} F_{d_y} = 0$$

- Obtained map is "dense"; In other methods, one may use only edges / not find matching points. But here every $(x,y)$ will have some "$d$".

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Post-processing (for 2)

Given $Z(i,j) = Z_{i,j}$ $\forall (i,j) \in S$. Find $Z(x,y)$ $\forall (x,y)$ subject to $\min \iint (Z_x^2 + Z_y^2)\, dx\, dy$

✓ Can relax to $\min \iint (Z_x^2 + Z_y^2) + \lambda (Z_{i,j} - Z(i,j))^2 \, dx\, dy$

Points where depth is estimated

Estimated depth

(to account for noise in estimating depth)



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