

March 14, 2019 Point Cloud Background

CMPE297 Video Analytics. March 14/2019. HL

References: 1° github 2015-32-~ Introduction DNN.

2° " " 33-~ 3D Math.

Background Formulations
For Point Net (3D Input Data To Train Convolution Neural Network)

Step1 3D Input Data.

StereoVision

"Point Cloud"

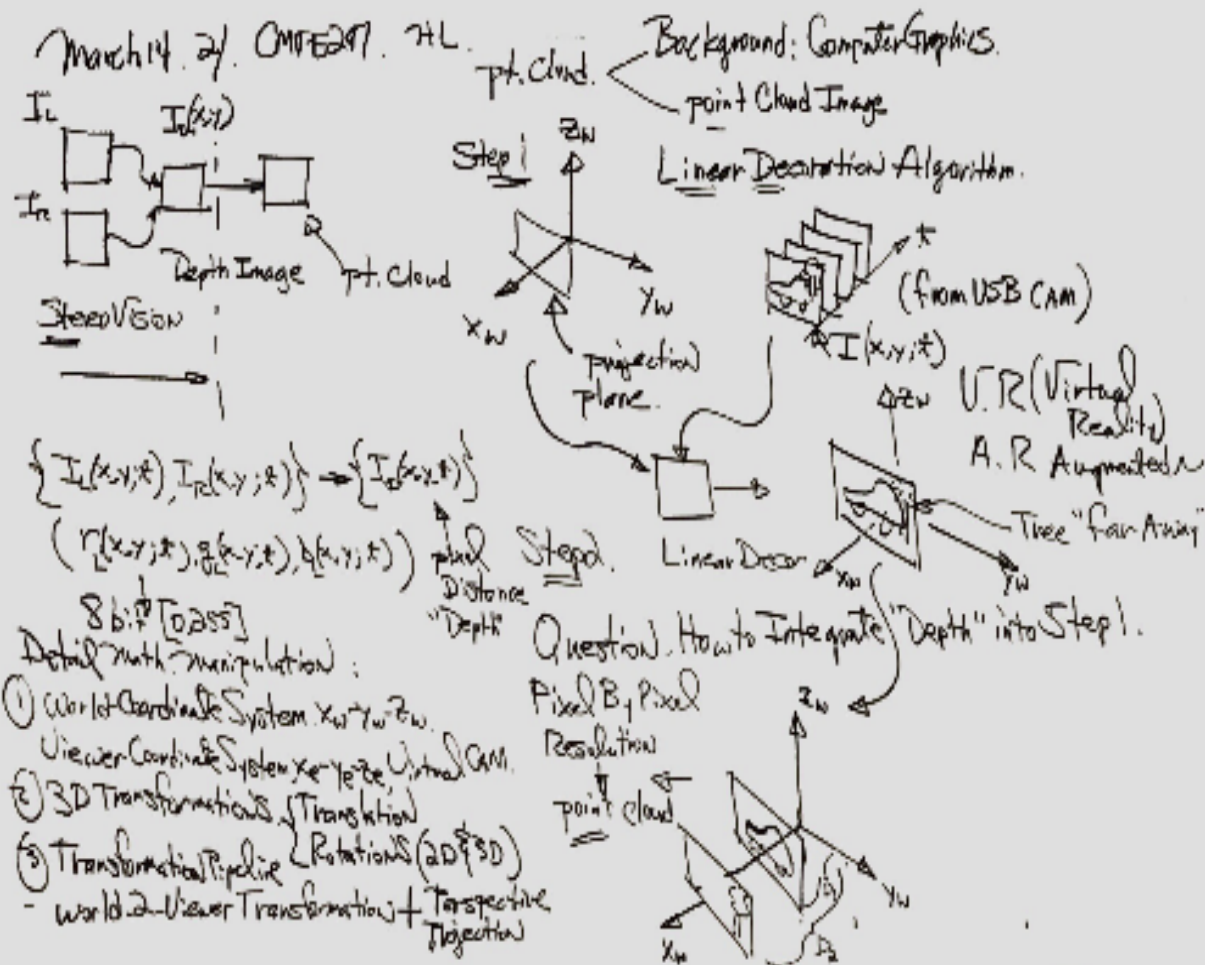
(From 3D depth map)

Note: 1° Homework I e-mail submission.

hva.li@spu.edu; 2° Homework 2 Due in class.

(Video input) (USB CAM 5 minute Show & Tell)

2° midterm Exam. Last Class Before Spring Break. March 28.



March 14, 2019 Point Cloud Formulation I

(4) Linear Descent. In $X_0 \rightarrow \mathbb{P}^1 \rightarrow \mathbb{C}^*$ (world)

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graph LR
    1((1)) --> USB[USB  
(CAM OR  
File  
I/O)]
    USB --> 4((4))
    4 --> Depth[Depth Based  
Projection  
pt. cloud]
    1 --> Proj1[Projection  
Plane]
    4 --> Proj4[Linear-Decor  
On Projection  
Plane]

```

Consider Decantation Algorithm.

Example: Given 3D X_w, Y_w, Z_w ("world")

⑥ Place projection plane $D=100$

②

Capture + Display One Image

Inv

$$\begin{aligned} \text{Height: } 100 \\ \text{width: } 200 \\ \{ \vec{p}_i(x_i, y_i, z_i) \mid i=1,2,3,4 \} \end{aligned}$$

③ $2D \rightarrow 3D$ -
By Adding Z_i

$$\begin{cases} X_i' = X_{i2} & y_i' = y_{i2} \\ Z_i' = 0 & \text{for } X_{i1} - X_{i2} \text{ plane} \\ & \dots \end{cases} \quad (1)$$
$$\begin{cases} y'_i = x_i; & z'_i = y_i; \\ \text{C}_{(Ind.)} & x'_i = 0 \end{cases} \quad \dots (2)$$

Plan:

$$Y_1' = X_1; Z_1' = Y_2; X_1' = D$$
$$\begin{cases} Y_{-Prim}[i] = X[i]; \\ Z_{-Prim}[i] = Y[i]; \\ X_{-Prim}[i] = D; \end{cases} \quad \downarrow$$

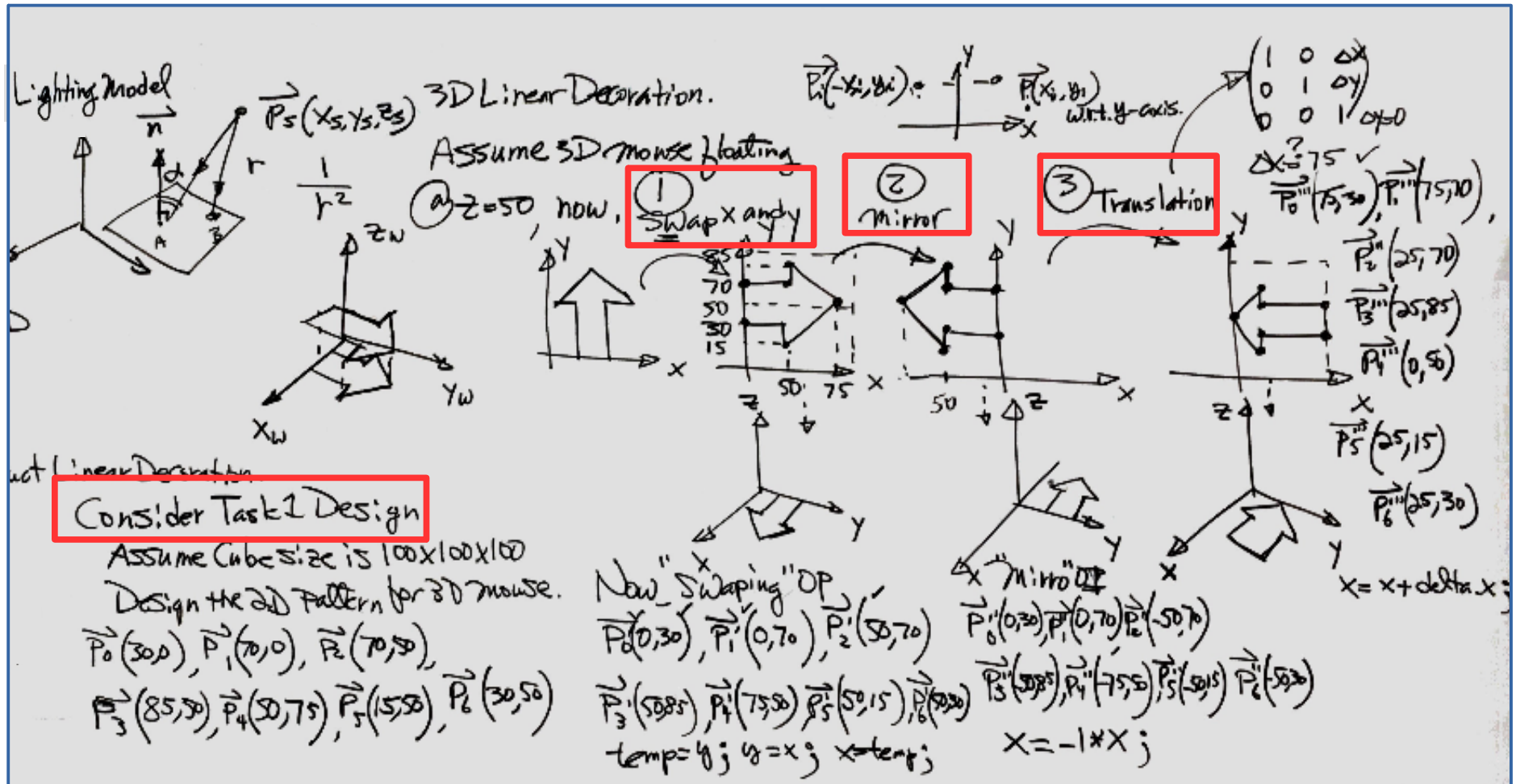
$$Y_i' = X_i - WdH_{\frac{1}{2}};$$

Match Resolution:

$M \rightarrow \text{width}$, $N \rightarrow \text{Height}$
 $[0, M-1]$ $[1, W]$ $[0, N-1]$ $[1, H]$

Wf. - Fig 1.

Design 2D Cursor Pattern then 3D Decoration



3D Decoration

CMPE163 Introduction To
Computer Graphics & AR HL.3/

Now, With Linear Decoration we
can change $\{\vec{P}_i(x_i, y_i) | i=0, 1, \dots, 6\}$
to 3D mouse, by adding z-dimension,
such that $z_i = 50$, Hence, we have

$$\left\{ \vec{P}_i(x_i, y_i, z_i) \mid i=0, 1, 2, \dots, 6 \right\}$$

$$z_i = 50$$

$$\vec{P}_0(75, 30, 50), \vec{P}_1(75, 70, 50), \vec{P}_2(25, 70, 50), \vec{P}_3(25, 85, 50)$$

$$\vec{P}_4(0, 50, 50), \vec{P}_5(25, 15, 50), \vec{P}_6(25, 30, 50)$$

Make the pattern with Thickness=5.

$$S1: \{ \vec{P}_i(x_i, y_i, z_i) \mid i=0, 1, 2, \dots, 6 \}$$

Then, (Layer Beneath S_1)

$$S2: \{ \vec{P}_i(x_i, y_i, z_i - 5) \mid i=0, 1, 2, \dots, 6 \}$$

"Wire frame" \rightarrow Solid Object

Hidden Line / Surface Removal.

Background

1. Define Vertices of 3D Object(s) in Counter Clock Wise Direction.
(When Viewing the Object from the outside)

