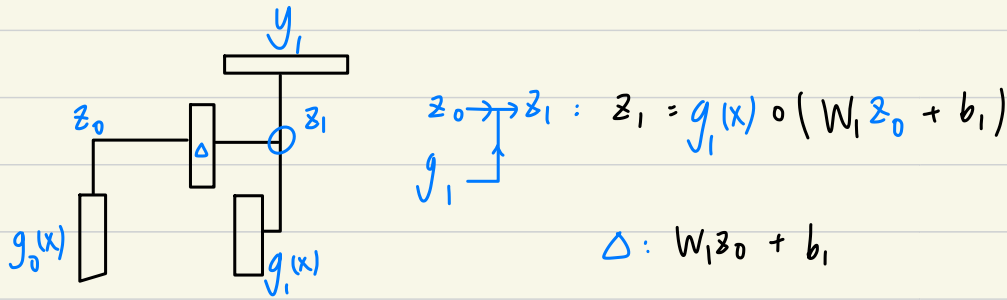


Pipeline :

initial input :  $x \in d^{in}$ ,  $d^{in} = 2$  or  $3 \leq 2d$  or  $3d$  coordinate



$$g_0(x) = \sin(W_0 x + \phi_0)$$

$$g_0 = z_0$$

$$d^h \times d^{in} \frac{W_0 x}{d^{in}} + \phi_0 \in d^h$$

$$W_0 \in [-B_0, B_0] \text{ , if } W_1 \text{ also } \in [-B_0, B_0]$$

$$2B_0 = B \Rightarrow z_1 \text{'s bandwidth will be } \leq 2B$$

$$y_1 = W_1^{out} z_1 + b_1^{out}$$

$$d_h \begin{bmatrix} W_0 x \\ d_{in} \end{bmatrix} \begin{bmatrix} \end{bmatrix} d_{in}$$

$W_0$

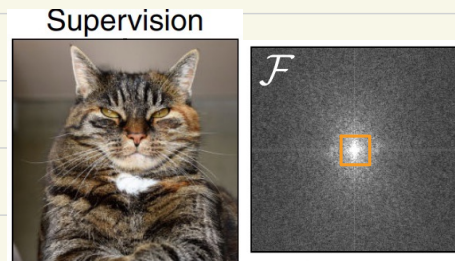
what are entries of  $w_i$ ?

random uniform initialization from  $[-B_0, B_0]$ , or in coding  
`random.uniform(-B_i, B_i, d_h * d_in)`

$y_1$  and its spectrum



Supervisory



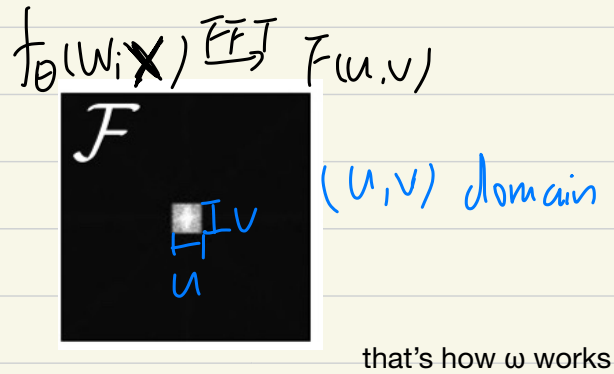
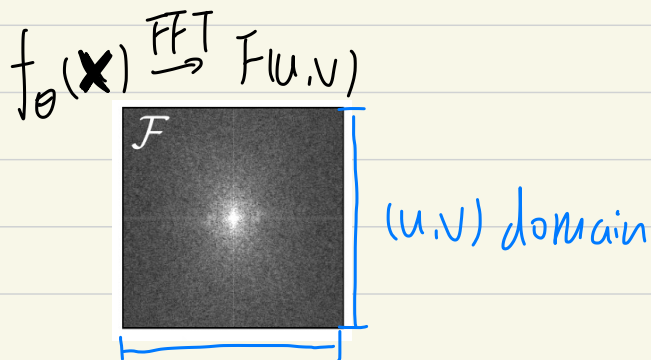
learn for each (u, v) coordinate

Guess\_1: the output dimension should be 1, which represents the value of frequency magnitude because "the network is characterized entirely by its Fourier spectrum". We should train in the Fourier frequency domain, and visualize the performance in image domain by inverse Fourier transform.

$f_{\theta}(w_i \mathbf{x}) \xrightarrow{\text{FFT}} \tilde{F}(u, v) = \tilde{F} - \underline{F} \xleftarrow{\text{FFT}} f(\mathbf{x})$

unknown, what we want to train      predicted output      real frequency value by supervisory image      supervisory image

$\mathbf{x} = (x, y)$        $w_i \mathbf{x}$  limit the possible coordinate in frequency domain  $(u, v)$  will not appear out of expected frequency domain



$$g_i(\mathbf{x}) = \sin(w_i \mathbf{x} + \phi_i)$$

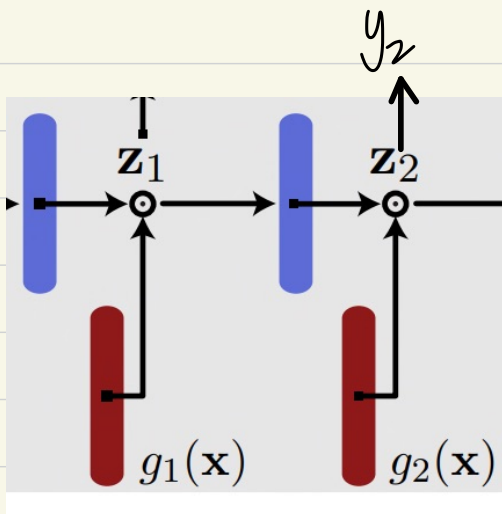
$$z_i = g_i(\mathbf{x}) \mid w_i z_{i-1} + b_i$$

— : freeze

$$y_i = w_i^{\text{out}} z_i + b_i^{\text{out}}$$

— : trainable

$$f_{\theta}(w_i \mathbf{x})$$



$$z_2 = g_2(x) \circ (w_2 z_1 + b_2)$$

$\leq 2B$

$$\sin(w_2 x + \phi_2)$$

$B$

$\Rightarrow z_2 \text{ and } y_2 \leq 3B$

frequency

$$f_{\theta}(\mathbf{x}) = \text{the value of signal (maybe grayscale or RGB, need to be checked)}$$

where  $x$  is input coordinate