

Data-Generation Model Checkpoint

1 Pattern bank

For each pattern $k \in \{0, \dots, K-1\}$ and component $c \in \{0, \dots, 8\}$ we store

$$g_{k,c} \in \{0, 1\}, \quad m_{k,c} \geq 0, \quad \varphi_{k,c} \in (-\pi, \pi], \quad \phi_{k,c}^f, \phi_{k,c}^t \in (-\pi, \pi].$$

Unit-norm energy on active cells

$$\sum_{c: g_{k,c}=1} m_{k,c}^2 = 1.$$

Continuous offsets

$$\delta f_{k,c} = \frac{5}{2\pi} \phi_{k,c}^f, \quad \delta n_{k,c} = \frac{5}{2\pi} \phi_{k,c}^t, \quad (\delta f, \delta n \in [-2, 2]).$$

Component value

$$P_{k,c} = m_{k,c} e^{j\varphi_{k,c}} \in \mathbb{C}.$$

2 Occurrences

For each occurrence r :

$$k_r, \quad Z_r^f = e^{j\zeta_r^f}, \quad Z_r^t = e^{j\zeta_r^t}, \quad A_r = \rho_r e^{j\theta_r}.$$

Decoded (possibly fractional) centre

$$f_r = \frac{F}{2\pi} \arg Z_r^f, \quad n_r = \frac{N}{2\pi} \arg Z_r^t.$$

3 Synthesis

For every active component of pattern k_r

$$\hat{f} = f_r + \delta f_{k_r,c}, \quad \hat{n} = n_r + \delta n_{k_r,c}.$$

Let $f_1 = \lfloor \hat{f} \rfloor$, $n_1 = \lfloor \hat{n} \rfloor$, $w_f = \hat{f} - f_1$, $w_n = \hat{n} - n_1$. The complex value

$$\text{val} = A_r P_{k_r,c} g_{k_r,c}$$

is distributed to the four neighbouring lattice cells with bilinear weights

$$(1 - w_f)(1 - w_n), \quad (1 - w_f)w_n, \quad w_f(1 - w_n), \quad w_f w_n.$$

4 Feature tensor

$$X[f, n, :] = (A_{f,n}, e^{j\frac{2\pi f}{F}}, e^{j\frac{2\pi n}{N}}) \in \mathbb{C}^3.$$