Generative Model Checkpoint
SparseGrid–3×3, Stride–2

1 Pattern dictionary

- Size: $K+1$ patterns; ID 0 is the *background pattern.*
- For each $k \geq 1$ store nine complex coefficients

$$P_{k,\Delta f,\Delta n} \in \mathbb{C}, \qquad \Delta f, \Delta n \in \{-1, 0, +1\}.$$

  Coefficients that are structurally inactive are set to 0.
- Energy normalisation: $\sum_{\Delta f,\Delta n} |P_{k,\Delta f,\Delta n}|^2 = 1.$
- Background pattern: all nine coefficients are 0.

2 Occurrence lattice

- Fixed centres every second pixel: $\mathcal{C} = \{(2i,\, 2j) \mid i = 0, \ldots, \lceil F/2 \rceil - 1,\ j = 0, \ldots, \lceil N/2 \rceil - 1\}.$
- For each centre $(f, n) \in \mathcal{C}$ sample
  1. Pattern ID $k_{f,n} \in \{0, \ldots, K\}$,
  2. Micro–shift phases $Z^f_{f,n} = e^{j\zeta^f_{f,n}},\ Z^n_{f,n} = e^{j\zeta^n_{f,n}},\ \zeta \in (-\pi, \pi]$,
  3. Occurrence amplitude $A_{f,n} = \rho_{f,n} e^{j\theta_{f,n}}$.

  If $k_{f,n} = 0$ set $A_{f,n} = 0$ and omit the rotators.

Continuous offsets derived from micro–shifts:

$$\delta f = \frac{2}{2\pi} \arg Z^f_{f,n} \in (-1, 1), \qquad \delta n = \frac{2}{2\pi} \arg Z^n_{f,n} \in (-1, 1).$$

3 Deposition

For each non–background occurrence and every cell $(\Delta f, \Delta n)$ with $P_{k,\Delta f,\Delta n} \neq 0$:

$$\hat{f} = f + \Delta f + \delta f, \qquad \hat{n} = n + \Delta n + \delta n.$$

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

$$\mathrm{val} = A_{f,n}\, P_{k,\Delta f,\Delta n}$$

to the four neighbouring lattice cells with weights $(1 - w_f)(1 - w_n)$, $(1 - w_f)w_n$, $w_f(1 - w_n)$, $w_f w_n$.

4 Bitstream

- Transmit patterns (ID $1 \dots K$); pattern 0 is implicit.
- For every lattice slot transmit the pattern ID. If ID $\neq 0$ also transmit ζ^f, ζ^n and $A_{f,n}$.
- Runs of background IDs are run–length–encoded.