

$$-\log_2\left(\frac{1}{\pi}\right)$$

$$z_{ik} = z_i + jz_k$$

~~del~~

$$\begin{aligned} \sum_x Q(x) &\leq \sum_i \sum_k w_i w_k \cdot \left( \left( \frac{1}{G(z_{ik})^{1+p}} \right)^p \cdot \left( \sum_x Q(x) G(\dots)^{\frac{1}{1+p}} \right)^p \right) \\ &= \sum_x Q(x) \sum_{i=1}^N \sum_{k=1}^N w_i w_k G(z_{ik})^{-\frac{p}{1+p}} \cdot \left( \sum_x Q(x) \cdot G(z_{ik} + \sqrt{N} w_i x - \sqrt{N} w_k x)^{\frac{1}{1+p}} \right)^p \\ &= \underbrace{Q^T}_{1 \times M} * \underbrace{\left( \pi \cdot G^{-\frac{p}{1+p}} \right)}_{M \times N^2 M} * \underbrace{\left( \underbrace{Q^T}_{1 \times M} * \underbrace{G^{\frac{1}{1+p}}}_{N^2 M \times 1} \right)^T}_{N^2 M \times 1} \end{aligned}$$

$$G \cdot ^{-1/(1+p)}$$

$$\begin{aligned} \sum_{i=1}^n a_i b_i &= (a_1 \dots a_n) \begin{pmatrix} b_1 \\ \vdots \\ b_n \end{pmatrix} = a^T * b \\ \sum_{i=1}^n \sum_{k=1}^n A_{ik} b_k &= \begin{pmatrix} A \end{pmatrix} \begin{pmatrix} b_1 \\ \vdots \\ b_n \end{pmatrix} = A * b \end{aligned}$$

$$Q = \begin{bmatrix} Q(x_1) \\ Q(x_2) \\ \vdots \\ Q(x_M) \end{bmatrix} \quad \text{where } M = |X|$$

$$\pi = \begin{bmatrix} \overbrace{w_1 w_1 \dots w_1 w_N}^{N^2} & \overbrace{0 \dots 0}^{N^2} & \dots & \overbrace{0 \dots 0}^{N^2} \\ 0 & \overbrace{w_1 w_1 \dots w_N w_N}^{N^2} & 0 & \dots \\ \vdots & \vdots & \ddots & \vdots \\ 0 & \dots & \dots & \overbrace{w_N w_N \dots w_N w_N}^{N^2} \end{bmatrix}_{M \times N^2 M}$$

$$G = \begin{bmatrix} G(z_{11} + \sqrt{N} w_1 x_1 - \sqrt{N} w_1 x_1) & \dots & G(z_{1N} + \sqrt{N} w_1 x_1 - \sqrt{N} w_N x_1) & G(z_{1N} + \sqrt{N} w_1 x_1 - \sqrt{N} w_N x_2) & \dots & G(\dots x_2) \dots \\ G(x_2 \ x_N) \dots G(x_2 \ x_N) & G(x_2 \ x_N) & G(x_2 \ x_2) & \dots & \dots & \dots \end{bmatrix}_{M \times N^2 M}$$

row i block K is  $G(z_{11} + \sqrt{N} w_i x_i - \sqrt{N} w_N x_K) \dots G(z_{1N} + \sqrt{N} w_i x_i - \sqrt{N} w_N x_K)$

