ElementSets from MeshConnectivity

NeighborVerticesInFace, Faces, VertexOneRing from Neighborhoods(M)

$$M: \text{TriangleMesh}$$
$$x_i \in \mathbb{R}^3$$

$$V, E, F = \mathit{ElementSets}(M)$$

$$\mathit{VertexNormal}(i) = \frac{w}{\|w\|}$$
where
$$i \in V$$
$$w = \sum_{f \in \mathit{Faces}(i)} (x_j - x_i) \times (x_k - x_i) \qquad \text{where } j, k = \mathit{NeighborVerticesInFace}(f, i)$$

$$\mathit{CalcNorm}(i, v, n, \sigma_c, \sigma_s) = w_c \cdot w_s$$
where
$$i, v \in \mathbb{Z}, \text{ vertices}$$
$$\sigma_c, \sigma_s \in \mathbb{R}$$
$$n \in \mathbb{R}^3$$
$$t = \|x_i - x_v\|$$
$$h = \langle n, x_v - x_i \rangle$$
$$w_c = e^{-\frac{t^2}{2\ \sigma_c{}^2}}$$
$$w_s = e^{-\frac{h^2}{2\ \sigma_s{}^2}}$$

$$\mathit{CalcS}(i, v, n, \sigma_c, \sigma_s) = \mathit{CalcNorm}(i, v, n, \sigma_c, \sigma_s) \cdot h$$
where
$$i, v \in \mathbb{Z}, \text{ vertices}$$
$$\sigma_c, \sigma_s \in \mathbb{R}$$
$$n \in \mathbb{R}^3$$
$$h = \langle n, x_v - x_i \rangle$$

$$\mathit{DenoisePoint}(i) = x_i + n \cdot \left(\frac{s}{\mathit{norm}}\right)$$
where
$$i \in V$$
$$n = \mathit{VertexNormal}(i)$$
$$\sigma_c = \mathit{CalcSigmaC}(i)$$
$$\mathit{neighbors} = \mathit{AdaptiveVertexNeighbor}(i, \{i\}, \sigma_c)$$
$$\sigma_s = \mathit{CalcSigmaS}(i, \mathit{neighbors})$$
$$s = \sum_{v \in \mathit{neighbors}} \mathit{CalcS}(i, v, n, \sigma_c, \sigma_s)$$
$$\mathit{norm} = \sum_{v \in \mathit{neighbors}} \mathit{CalcNorm}(i, v, n, \sigma_c, \sigma_s)$$

$$\mathit{CalcSigmaC}(i) = \min(\{\|x_i - x_v\| \mid v \in \mathit{VertexOneRing}(i)\}) \text{ where } i \in V$$

$$\mathit{CalcSigmaS}(i, N) = \begin{cases} \sqrt{\mathit{offset}} + 10^{-12} & \text{if } \sqrt{\mathit{offset}} < 10^{-12} \\ \sqrt{\mathit{offset}} & \text{otherwise} \end{cases}$$
where
$$i \in V$$
$$N \subset V$$
$$n = \mathit{VertexNormal}(i)$$
$$\mathit{avg} = \sum_{v \in N} \frac{t}{|N|} \qquad \text{where } t = \sqrt{((x_v - x_i) \cdot n)^2}$$
$$\mathit{sqs} = \sum_{v \in N} (t - \mathit{avg})^2 \qquad \text{where } t = \sqrt{((x_v - x_i) \cdot n)^2}$$
$$\mathit{offset} = \frac{\mathit{sqs}}{|N|}$$

$$\mathit{AdaptiveVertexNeighbor}(i, n, \sigma) = \begin{cases} n & \text{if } |n| = |\mathit{target}| \\ \mathit{AdaptiveVertexNeighbor}(i, \mathit{target}, \sigma) & \text{otherwise} \end{cases}$$
where
$$i \in V$$
$$\sigma \in \mathbb{R}$$
$$n \subset V$$
$$\mathit{target} = \{v \mid v \in \mathit{VertexOneRing}(n), \|x_i - x_v\| < 2\ \ \sigma\} \cup n$$