Analysis of NVT-based Point Set Denoising in Parameter Space

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Some of the authors of this publication are also working on these related projects:

- Generalization of two-dimensional structures View project
- Geometry Filtering View project
**Point Set Denoising**

Our point set denoising [1] is an iterative, 3-phase algorithm for noisy point sets. Its parameters offer a variety of tuning opportunities. Used models are the gargoyle (real, noisy, irregular), the Chinese ball (real, noisy, many features), the fan disk (sharp features, near-flat areas, $\sigma_n = 0.28l_e$), the sphere ($\sigma_n = 0.19l_e$) and the cube (sharp features, $\sigma_n = 0.3l_e$), with the last 3 being synthetic and noisy. Standard values are $k = 6$, $p = 80$, $d = 3$, and $\alpha = 0.1$.

**Distance Constraint $\varepsilon$**

The parameter $\varepsilon \in \mathbb{R}^+$ decides, whether a vertex update takes place utilizing a movement forecast and a comparison to the moved distance (according to the initial position).

The sphere model and denoising applied with $\varepsilon \in \{0.05, 0.0876, 0.3\}$.

**Dihedral Angle Threshold $\rho$**

The threshold $\rho \in [-1, 1]$ decides whether a neighborhood weight gets assigned 0 or 1 w.r.t. normal similarity during its determination in phase 1 and 2.

The fan disk model, denoised versions with $\rho \in \{0.3, 0.9, 0.99\}$, the Chinese ball, denoised with $\rho = 0.75$, and the denoised rabbit with $\rho = 0.95, 0.99$.

**Eigenvalue Threshold $\tau$**

The value $\tau \in [0, 1]$ decides whether eigenvalues of the tensors in phase 1 and 2 get assigned 0 or 1. Dominant ones get strengthened, the others weakened.

The noisy fan disk, denoised versions with $\tau \in \{0.1, 0.35, 0.45\}$, denoised Chinese ball with $\tau = 0.1, 0.45$, and the rabbit model, denoised with $\tau = 0.25$.

**Iterations $p$ - Smoothing Limiter $\alpha$ - Damping Factor $d$**

Finally, we consider the number of iterations $p \in \mathbb{N}$, as the point set changes dynamically, the damping factor $d \in \mathbb{N}$, controlling the impact on the updated normal in phase 1, and the smoothing limiter $\alpha \in \mathbb{R}^+$, influencing the weights applied to flat points in phase 3. The convergence analysis is taken via the mean angular deviation (MAD) and an $L_2$ vertex-based error metric ($D_v$), see [1].

The cube model, denoised versions with $(\rho = 0.95, \tau = 0.3)$, $\alpha = 0.1$, $d = 3$, and the plotted error values.

**References**


**Future Work**

- Examining cross correlations between parameters
- Automatized model-based parameter selection