Guided Mesh Normal Filtering: Supplementary Material

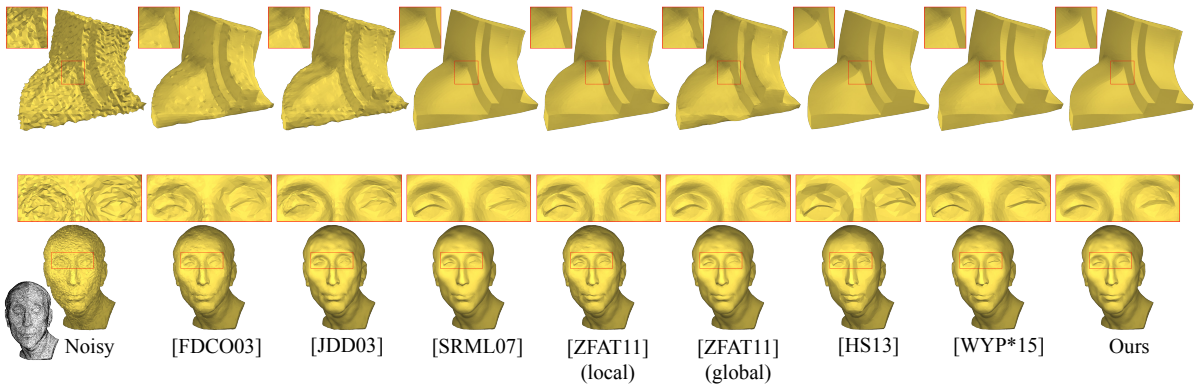

Figure A: Comparison of denoising algorithms for meshes with additive Gaussian noise. The intensity σ_E of the noise is from top to bottom 0.3 and 0.2.

1 More results

In Fig. A we provide more results of denoising meshes with additive Gaussian noise. The corresponding error metrics are provided in Table A.

Model	Error	[FDCO03]	[JDD03]	[SRML07]	[ZFAT11](l)	[ZFAT11](g)	[HS13]	[WYP*15]	Ours
Fandisk	δ	9.73	9.82	4.40	3.35	6.43	5.53	3.67	**2.78**
	$\mathcal{D}_{\text{mean}}$	$1.34{\cdot}10^{-2}$	$1.21{\cdot}10^{-2}$	$7.45{\cdot}10^{-3}$	$6.18{\cdot}10^{-3}$	$9.42{\cdot}10^{-3}$	$1.46{\cdot}10^{-2}$	$5.74{\cdot}10^{-3}$	$\mathbf{5.16{\cdot}10^{-3}}$
	$\mathcal{D}_{\text{max}}$	$2.94{\cdot}10^{-1}$	$2.61{\cdot}10^{-1}$	$2.35{\cdot}10^{-1}$	$2.25{\cdot}10^{-1}$	$2.53{\cdot}10^{-1}$	$2.59{\cdot}10^{-1}$	$2.12{\cdot}10^{-1}$	$\mathbf{2.09{\cdot}10^{-1}}$
Nicolo	δ	8.88	7.13	6.38	6.74	5.79	7.66	7.05	**6.10**
	$\mathcal{D}_{\text{mean}}$	$3.47{\cdot}10^{-1}$	$2.74{\cdot}10^{-1}$	$2.32{\cdot}10^{-1}$	$2.06{\cdot}10^{-1}$	$2.01{\cdot}10^{-1}$	$2.87{\cdot}10^{-1}$	$2.17{\cdot}10^{-1}$	$\mathbf{1.97{\cdot}10^{-1}}$
	$\mathcal{D}_{\text{max}}$	1.77	1.25	1.47	**1.06**	1.26	1.35	1.35	1.30

Table A: Error metrics for different methods. For each model, the best error metric value is highlighted in bold.

2 Parameters for denoising methods

Tables B to I provide the parameters for the methods compared in our paper. These parameters are applied to the denoising of the following models:

- In the paper:
  - Fig. 7: Fandisk ($\sigma_E = 0.7$), Julius, Sphere, Bunny.
  - Fig. 8: Block.
  - Fig. 9: Twelve.

Parameter	Fandisk(0.3)	Fandisk(0.7)	Julius	Sphere	Bunny	Nicolo	Block	Twelve	Angel	Rabbit	Iron
k_{iter}	10	10	15	17	12	12	15	12	10	13	100

Table B: Parameters used for [FDCO03].

Parameter	Fandisk(0.3)	Fandisk(0.7)	Julius	Sphere	Bunny	Nicolo	Block	Twelve	Angel	Rabbit	Iron
$\sigma_f/\|e\|$	1.3	1.6	1.3	1.8	1.2	1.4	1.3	1.2	1.2	1.3	3.8
$\sigma_g/\|e\|$	1.4	1.5	1.4	1.5	1.5	1.6	1.2	1.4	1.5	1.2	2.8

Table C: Parameters used for [JDD03].

Parameter	Fandisk(0.3)	Fandisk(0.7)	Julius	Sphere	Bunny	Nicolo	Block	Twelve	Angel	Rabbit	Iron
T	0.55	0.3	0.6	0.55	0.5	0.5	0.4	0.4	0.5	0.35	0.4
k_{iter}	20	30	10	30	5	8	30	15	6	4	20
v_{iter}	40	20	10	20	20	8	20	10	8	4	20

Table D: Parameters used for [SRML07].

Parameter	Fandisk(0.3)	Fandisk(0.7)	Julius	Sphere	Bunny	Nicolo	Block	Twelve	Angel	Rabbit	Iron
σ_s	0.35	0.4	0.45	0.45	0.5	0.45	0.35	0.33	0.4	0.35	0.35
k_{iter}	25	50	6	10	6	6	45	40	6	4	20
v_{iter}	20	20	4	8	20	6	20	20	6	4	10

Table E: Parameters used for [ZFAT11] (local).

  - Fig. 10: Angel, Rabbit, Iron.

- In this supplementary material:
  - Fig. A: Fandisk ($\sigma_E = 0.3$), Nicolo.

2.1 Explanation of parameters

- [FDCO03] (Table B):
  - k_{iter}: number of iterations.
- [JDD03] (Table C):
  - $\sigma_f/\|e\|$, $\sigma_g/\|e\|$: parameters that determine the variance for spatial and range kernels, with $\|e\|$ being the average edge length.
- [SRML07] (Table D):
  - T: threshold for controlling the averaging weights (see Equation (8) of [SRML07]).
  - k_{iter}: number of iterations for updating normals.
  - v_{iter}: number of iterations for a vertex update.
- Local scheme of [ZFAT11] (Table E):
  - σ_s: variance parameter for the spatial kernel.
  - k_{iter}: number of iterations for updating normals.
  - v_{iter}: number of iterations for a vertex update.
- Global scheme of [ZFAT11] (Table F):
  - σ_s: variance parameter for the spatial kernel.
  - λ: smoothness parameter in the target function.
  - v_{iter}: number of iterations for a vertex update.

Parameter	Fandisk(0.3)	Fandisk(0.7)	Julius	Sphere	Bunny	Nicolo	Block	Twelve	Angel	Rabbit	Iron
σ_s	0.35	0.45	0.45	0.45	0.5	0.5	0.38	0.38	0.4	0.35	0.35
λ	0.0001	0.0001	0.001	0.005	0.01	0.01	0.0002	0.0002	0.01	0.0001	0.0001
v_{iter}	20	30	5	15	20	8	18	20	6	4	10

Table F: Parameters used for [ZFAT11] (global).

Parameter	Fandisk(0.3)	Fandisk(0.7)	Julius	Sphere	Bunny	Nicolo	Block	Twelve	Angel	Rabbit	Iron
λ	0.01	0.01	0.000003	0.1	0.000004	0.6	0.55	5	0.0005	0.0035	0.0001
α_0	0.00346	1.0	0.00107	0.00206	1.0	0.00149	0.00389	0.00351	0.000924	0.000809	0.000912
β_0	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
μ_α	0.5	0.9	0.5	0.5	0.8	0.5	0.5	0.5	0.5	0.5	0.5
μ	1.414	1.414	1.414	1.414	1.414	1.414	1.414	1.2	1.414	1.414	1.414
$\beta_{\max}$	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000

Table G: Parameters used for [HS13].

Parameter	Fandisk(0.3)	Fandisk(0.7)	Julius	Sphere	Bunny	Nicolo	Block	Twelve	Angel	Rabbit	Iron
σ_{s1}	0.35	0.4	0.45	0.45	0.5	0.3	0.35	0.3	0.4	0.35	0.35
k_{iter}	20	50	6	6	5	6	50	75	5	4	20
σ_{s2}	0.3	0.3	0.4	0.4	0.45	0.35	0.3	0.3	0.35	0.35	0.3
v_{iter}	14	20	4	6	20	4	20	20	4	4	10

Table H: Parameters used for [WYP*15].

Parameter	Fandisk(0.3)	Fandisk(0.7)	Julius	Sphere	Bunny	Nicolo	Block	Twelve	Angel	Rabbit	Iron
r	0.12 (2×)	0.18 (2.6×)	-	0.8 (2×)	0.015 (2.7×)	3.4 (2×)	0.8 (2×)	0.116 (2×)	0.12 (2×)	0.6 (2×)	0.00564 (2×)
σ_r	0.25	0.3	0.45	0.45	0.55	0.35	0.3	0.2	0.3	0.35	0.4
k_{iter}	25	50	5	30	4	6	40	75	3	4	20
v_{iter}	20	20	4	20	15	6	30	20	2	4	10

Table I: Parameters used for our approach.

- [HS13] (Table G):
  - λ: weight for the L_0 term in the target function.
  - α_0, β_0: initial values for α and β in Algorithm 1 of [HS13].
  - μ_α, μ: update ratios for α and β.
  - $\beta_{\max}$: maximum value of β.
- [WYP*15] (Table H):
  - σ_{s1}: parameter for local face normal initialization.
  - k_{iter}: number of iterations for normal update in the local face normal initialization..
  - σ_{s2}: parameter for global face normal refinement.
  - v_{iter}: number of iterations for a vertex update.
- Ours (Table I): spatial variance is always chosen as the average distance between neighboring face centroids. Below are the tunable parameters:
  - r: radius for the geometrical neighborhood, also shown as the ratio with respect to the average distance between neighboring face centroids; not applicable if a topological neighborhood is used..
  - σ_r: variance of the range kernel.
  - k_{iter}: number of iterations for updating normals.
  - v_{iter}: number of iterations for a vertex update.

References

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