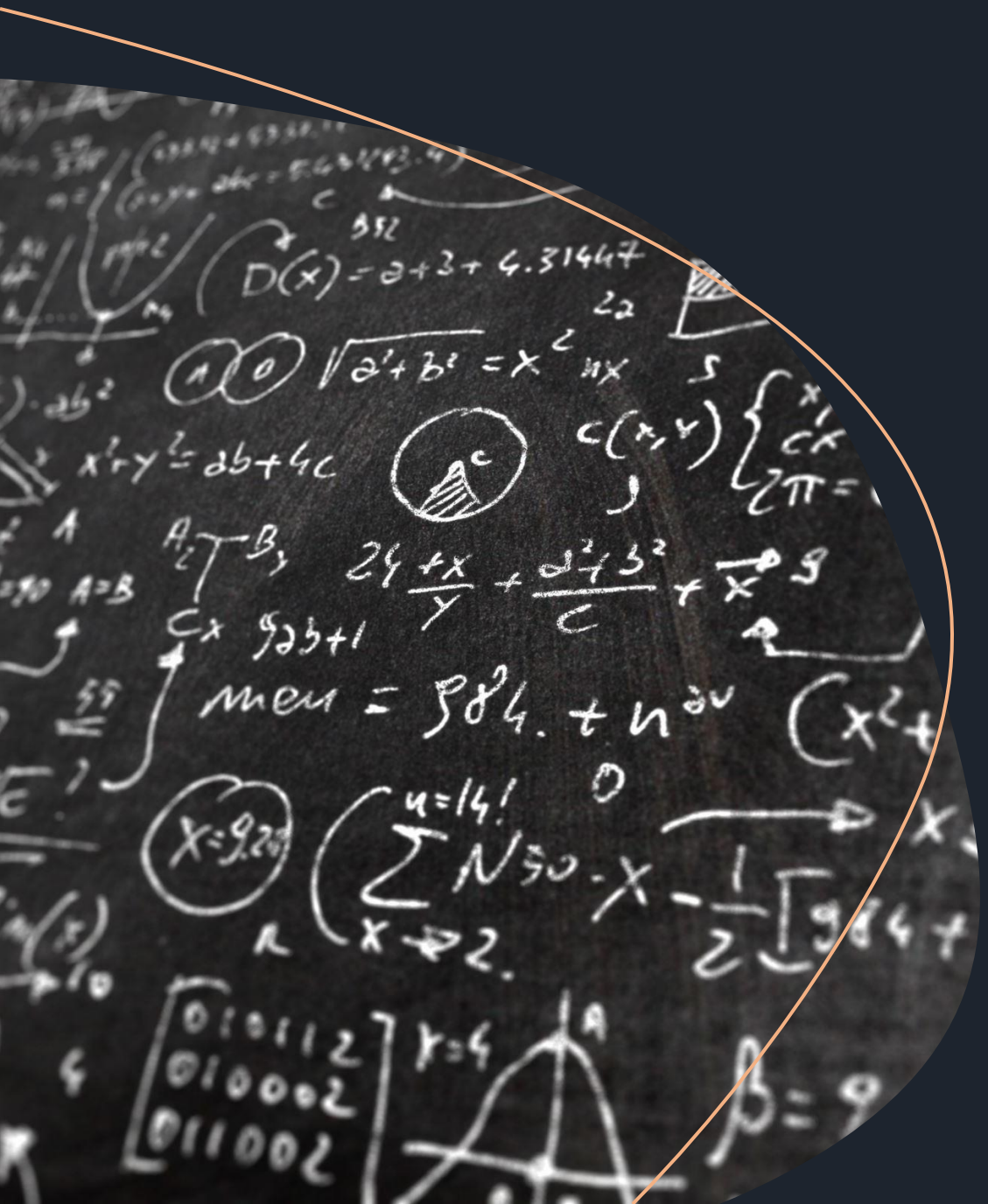


Deep Minimizing Movement Scheme

Y. Kees

20.01.2023

Algorithm | Constants

$$\theta_{k+1} := \operatorname{argmin}_{\Theta} \Phi(\Theta; \theta_k)$$

$$:= \operatorname{argmin}_{\Theta} \| v_{\Theta} - v_{\theta_k} \|^2_{H^1(\Omega;\tau)} + \tau \mathcal{A}(\Theta)$$

$$= \operatorname{argmin}_{\Theta} \int (v_{\Theta}(x) - v_{\theta_k}(x))^2 + \tau \left(\nabla v_{\Theta}(x) - \nabla v_{\theta_k}(x)\right)^2 \, \mathrm{d}x + \tau \mathcal{A}(\Theta)$$

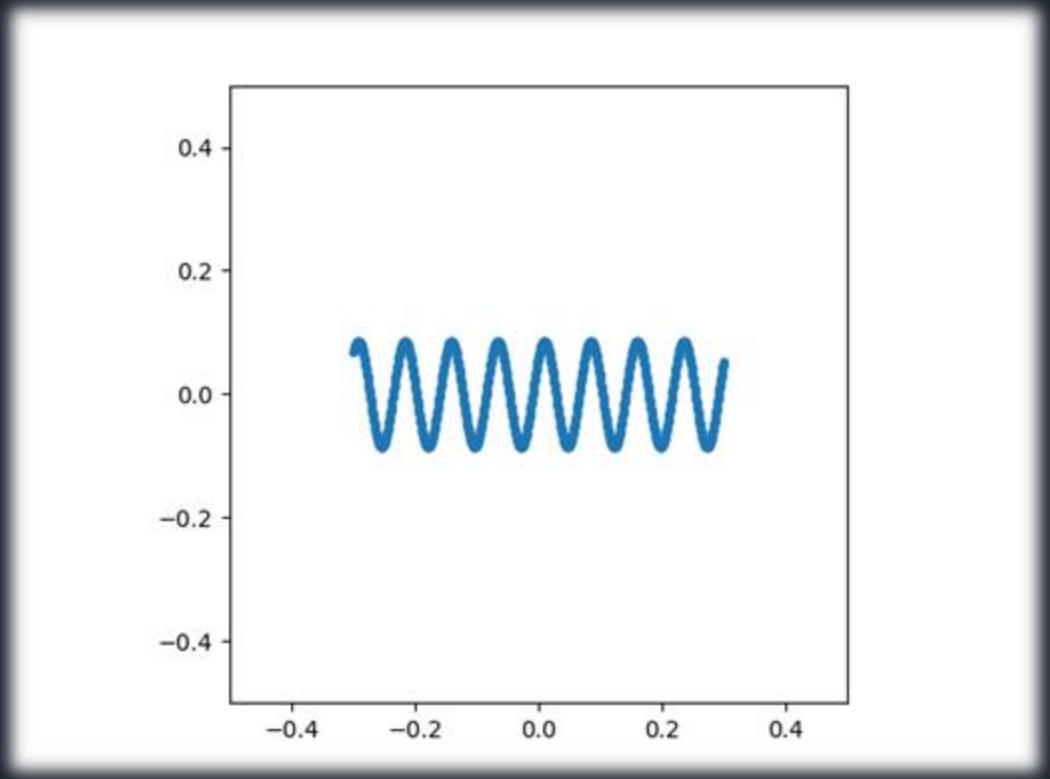
- NUM_TRAINING_STEPS = 1000
- START_LEARNING_RATE = 0.01
- PATIENCE = 1000
- NUM_NODES = 512
- MONTE_CARLO_SAMPLES = 500
- EPSILON = .01
- TAU = EPSILON
- CONSTANT = 2.0
- K = 15

Algorithmus 1 Deep Minimizing Movement Scheme

1: Guess θ_0
2: **for** $k = 0, ..., K$ **do**
3: $v_k \leftarrow$ NN with parameter θ_k in Evaluation mode only
4: $\theta_{k+1} \leftarrow \theta_k$
5: $v_{k+1} \leftarrow$ NN with parameter θ_{k+1}
6: **for** Number of Trainingssteps **do**
7: Loss function$\leftarrow \Phi(\theta_{k+1}, \theta_k)$
8: Backpropagate for training v_{k+1}
9: Make Optimization step
10: **end for**
11: **end for**

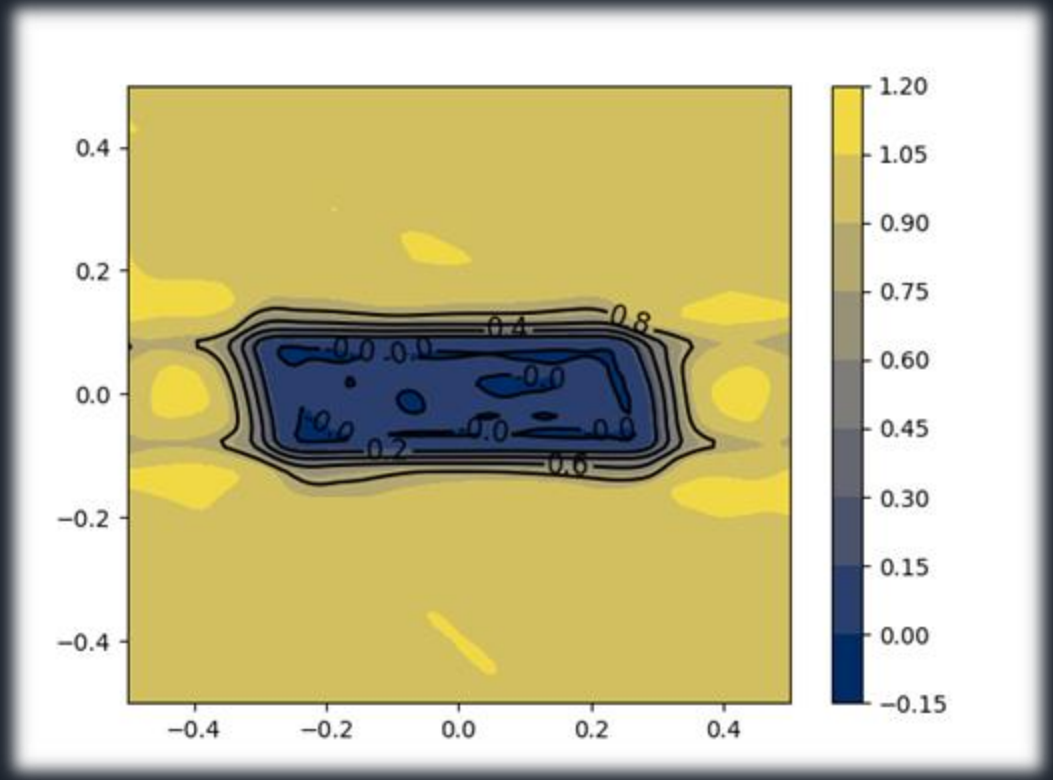
Input Point Cloud

- 1000 points
- sin(5x)+cos(5x) f -5:5
- ¢ GPT

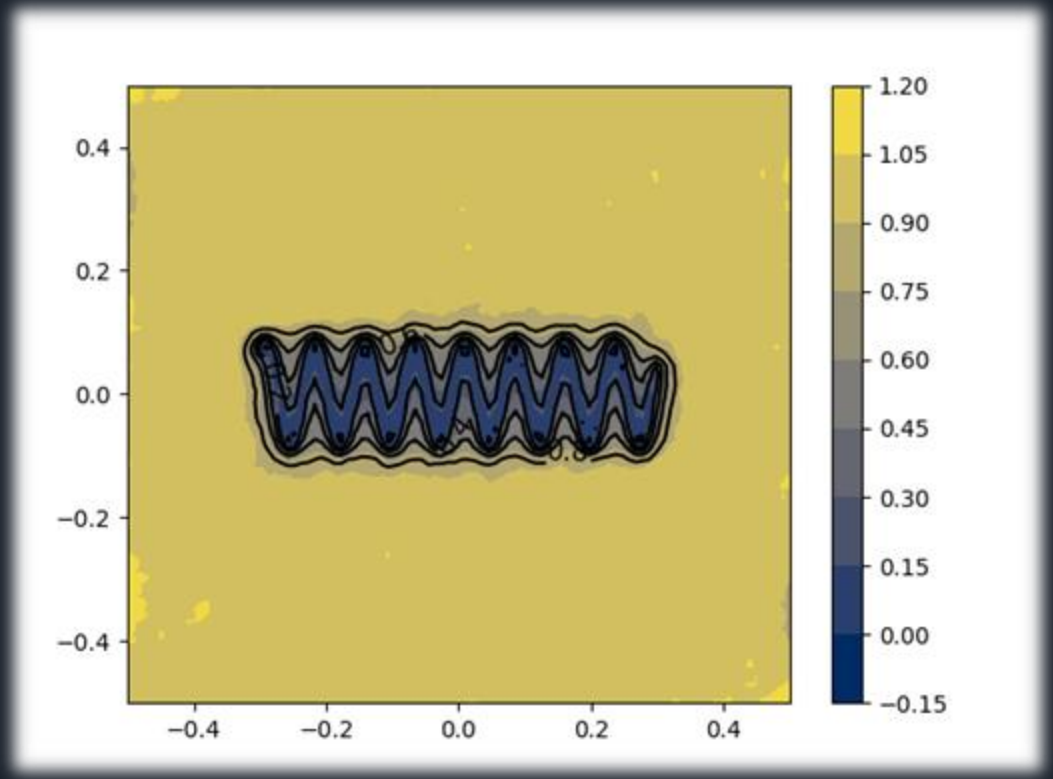


Plain surface reconstruction

Reconstruction without Fourier-Features

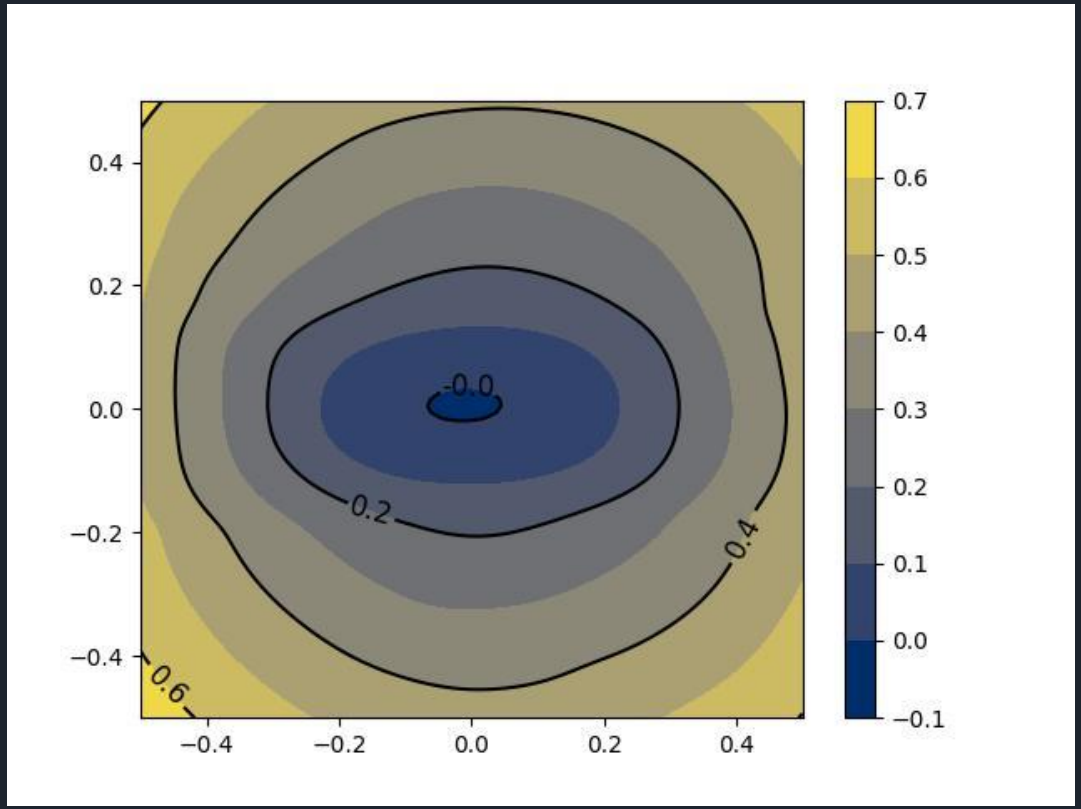


Reconstruction with Fourier-Features

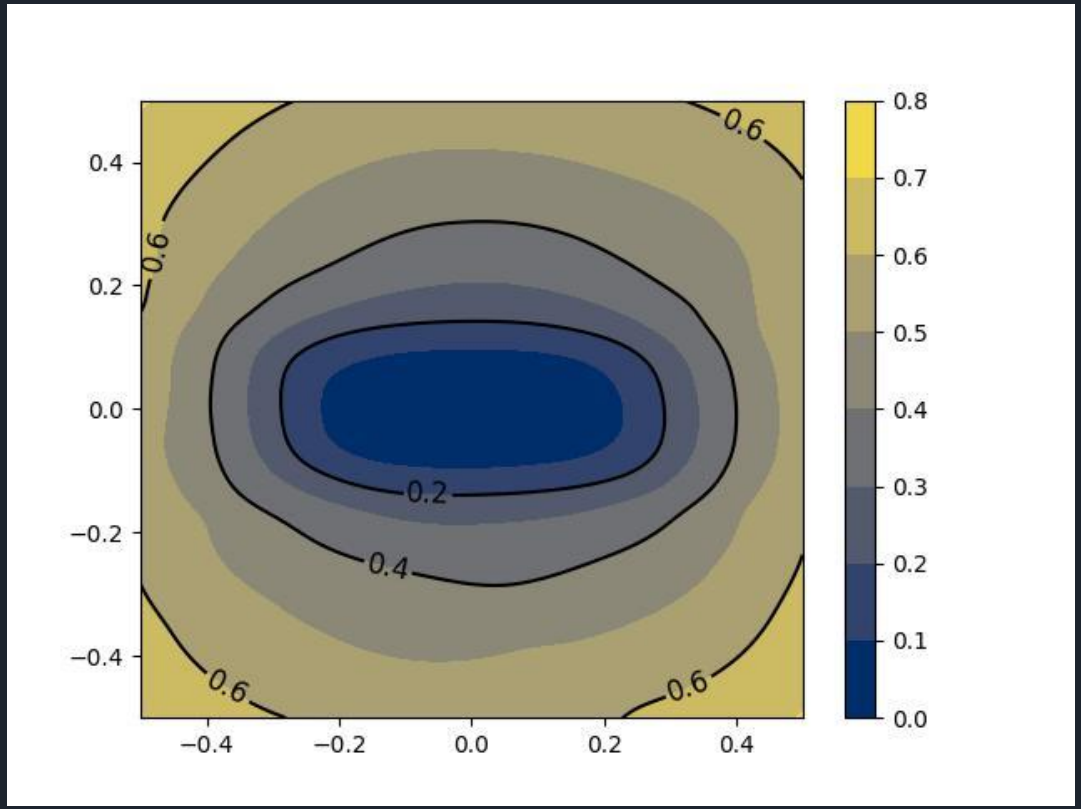


Surface reconstruction via minimizing movement scheme & without Fourier Features

k=1



k=2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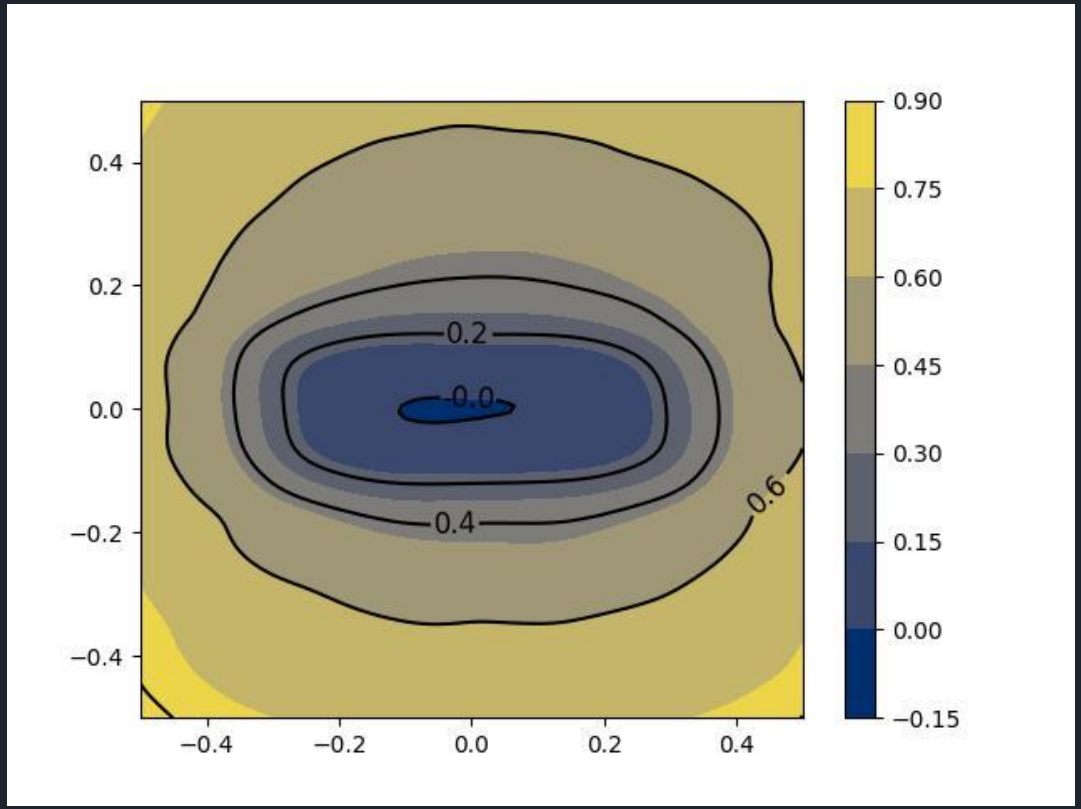
−0.2
0.0
0.2
0.4
0.6
0.6
0.2
0.4
0.6
0.6
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0

k=3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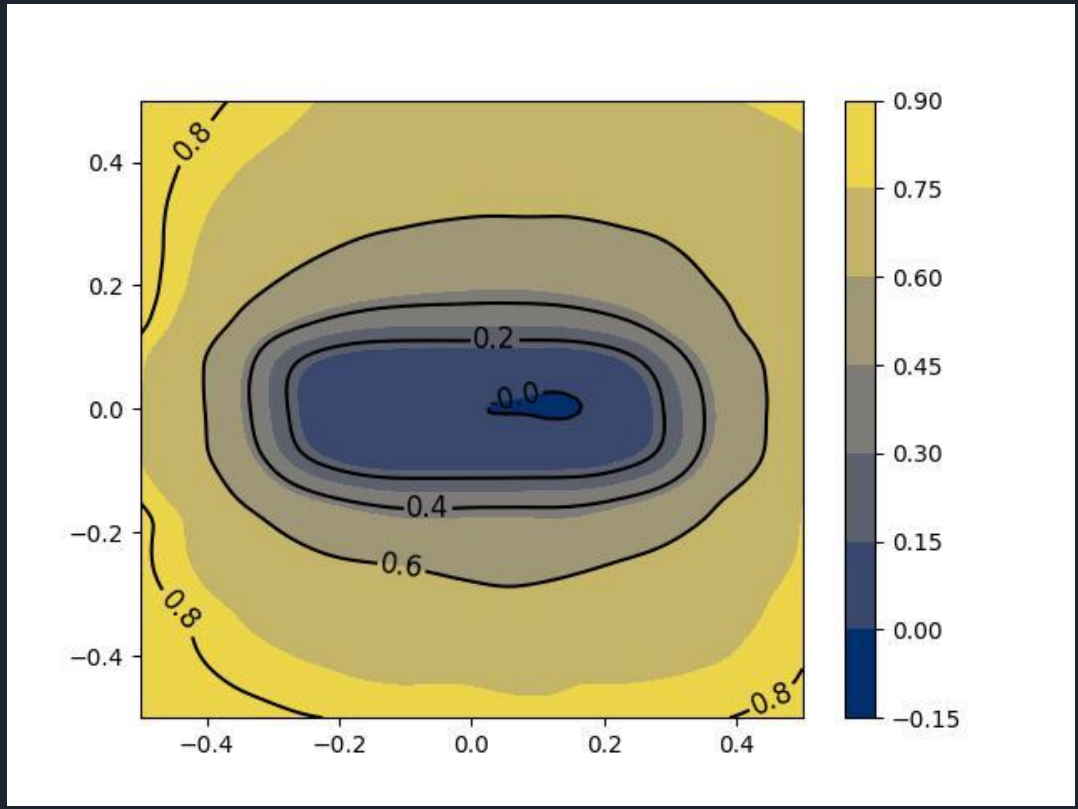
0.0
0.2
0.4
0.2
0.0
0.4
0.6
0.90
0.75
0.60
0.45
0.30
0.15
0.00
−0.15

k=4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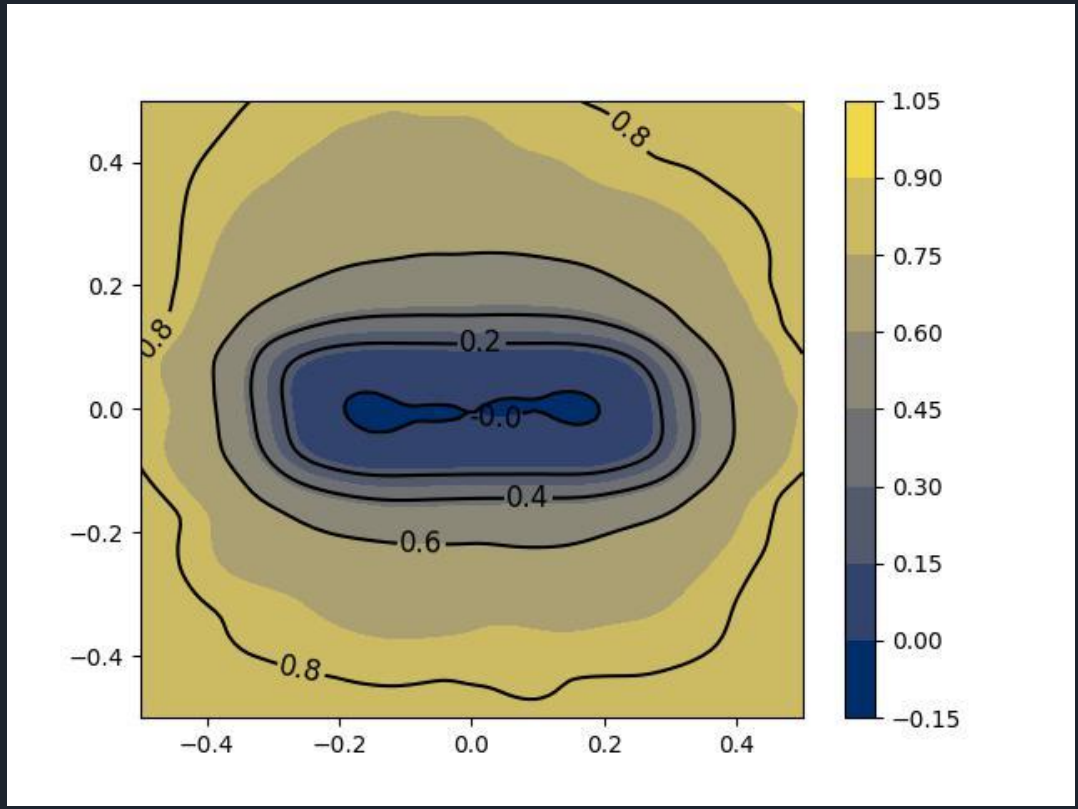
−0.4
−0.2
0.0
0.2
0.4
0.90
0.75
0.60
0.45
0.30
0.15
0.00
−0.15

k=5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0.4
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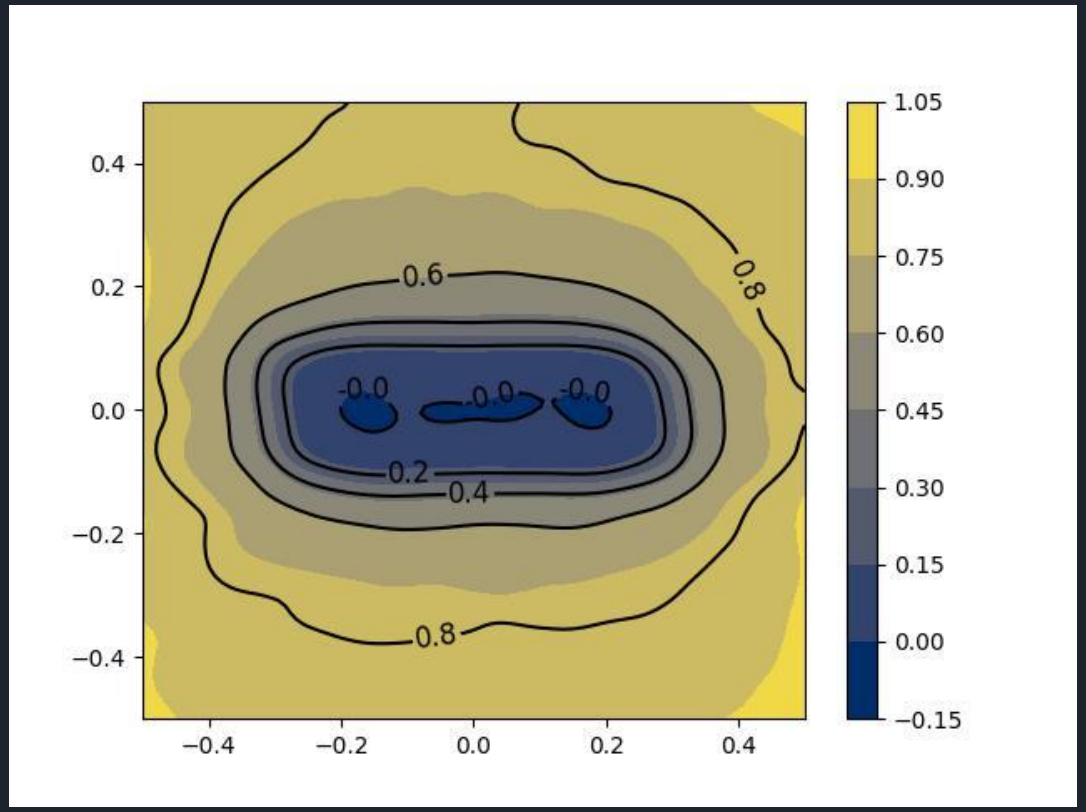
0.8
0.8
0.2
0.0
0.4
0.6
1.05
0.90
0.75
0.60
0.45
0.30
0.15
0.00
−0.15

k=6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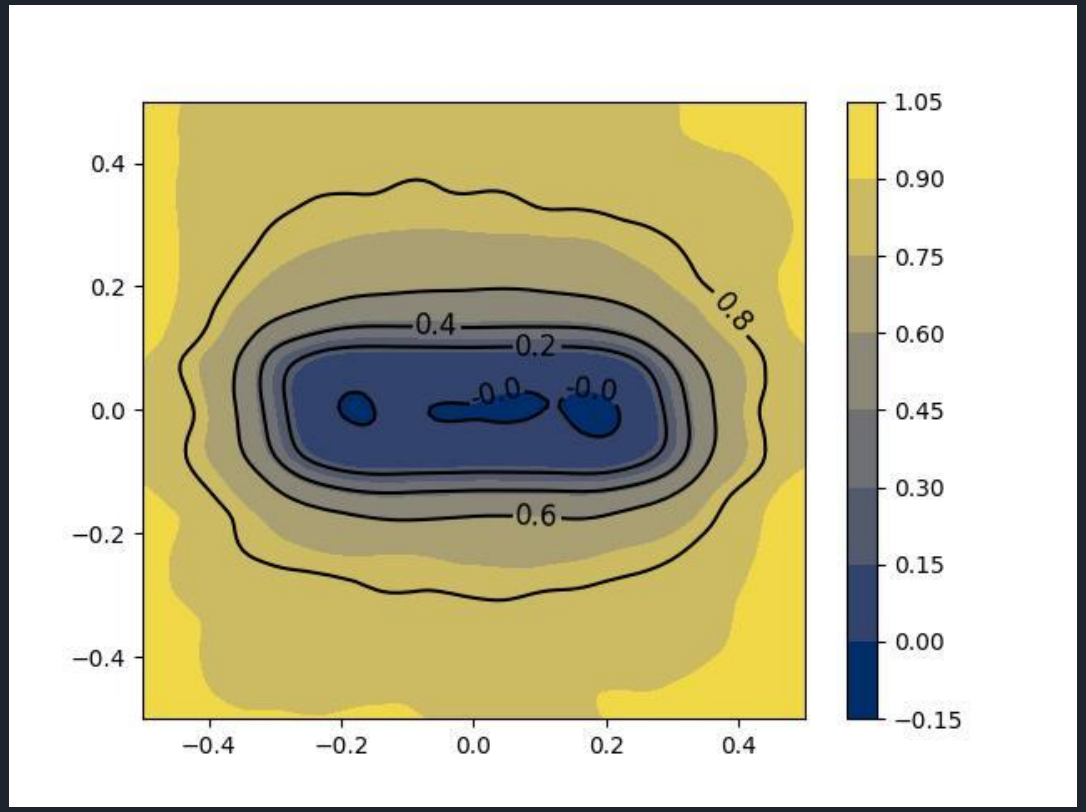
0.2
0.4
0.6
0.8
-0.0
-0.0
-0.0
0.2
0.4
0.8
1.05
0.90
0.75
0.60
0.45
0.30
0.15
0.00
−0.15

k=7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0.4
0.2
-0.0
-0.0
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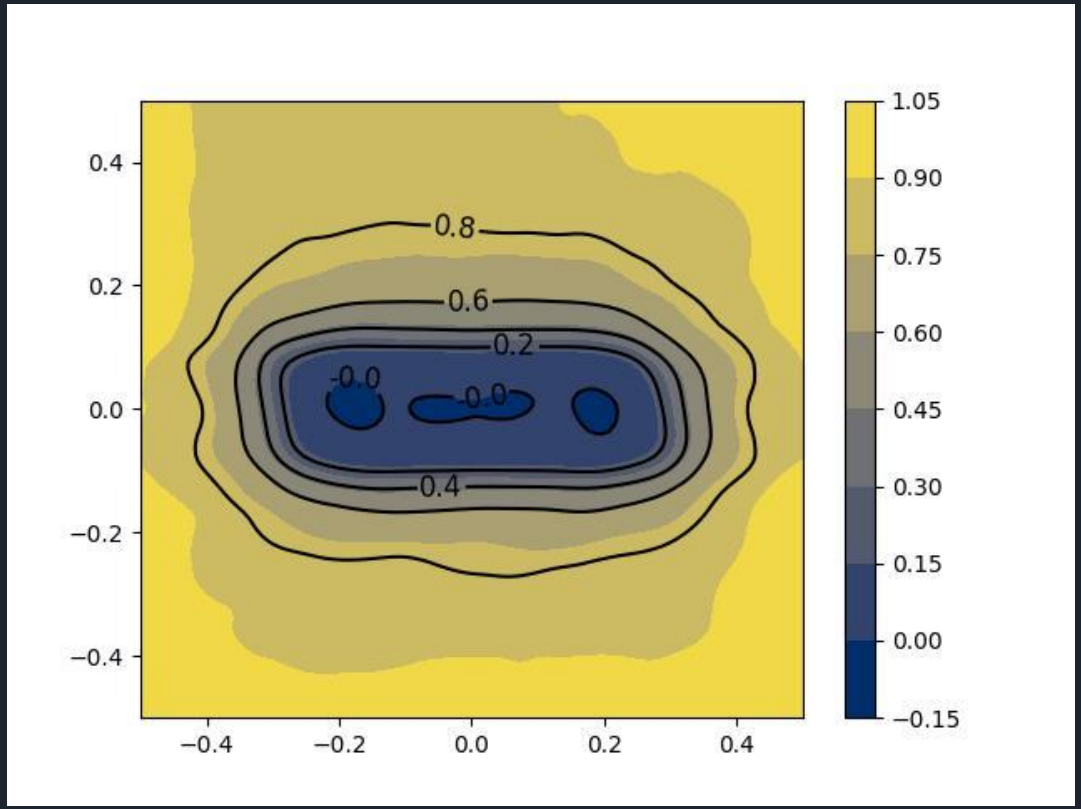
0.90
0.75
0.60
0.45
0.30
0.15
0.00
−0.15

k=8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0.6
0.2
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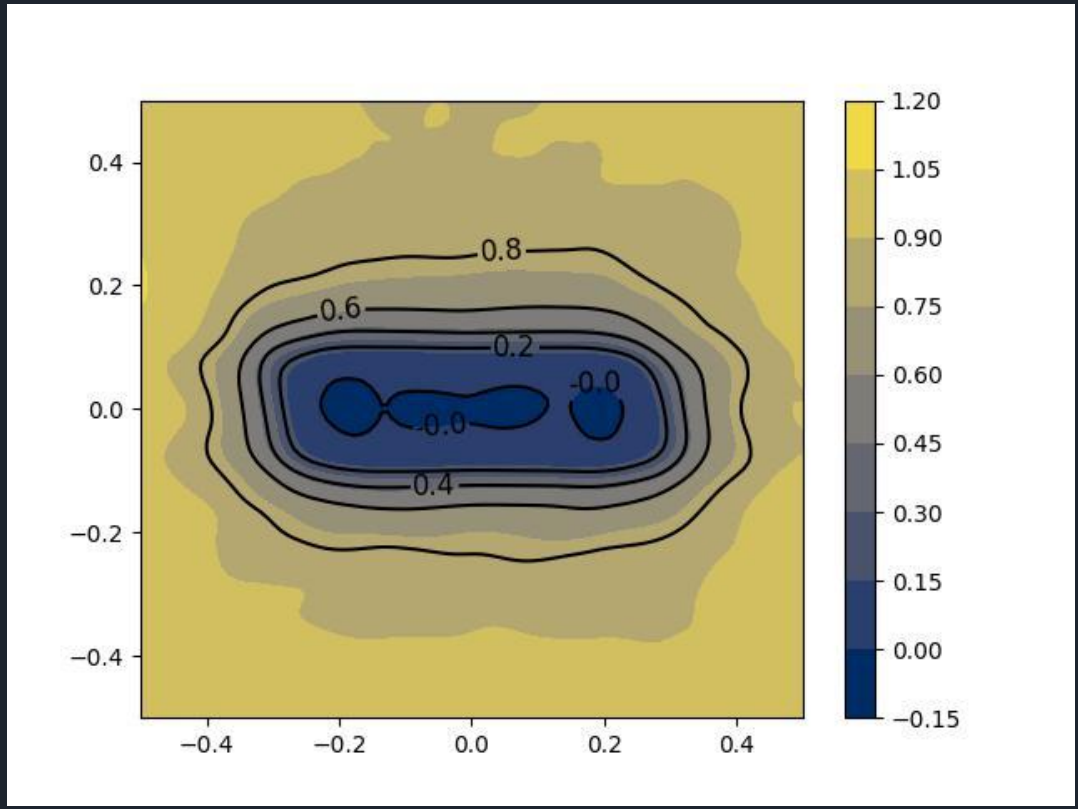
0.4
1.05
0.90
0.75
0.60
0.45
0.30
0.15
0.00
−0.15

k=9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0.6
0.2
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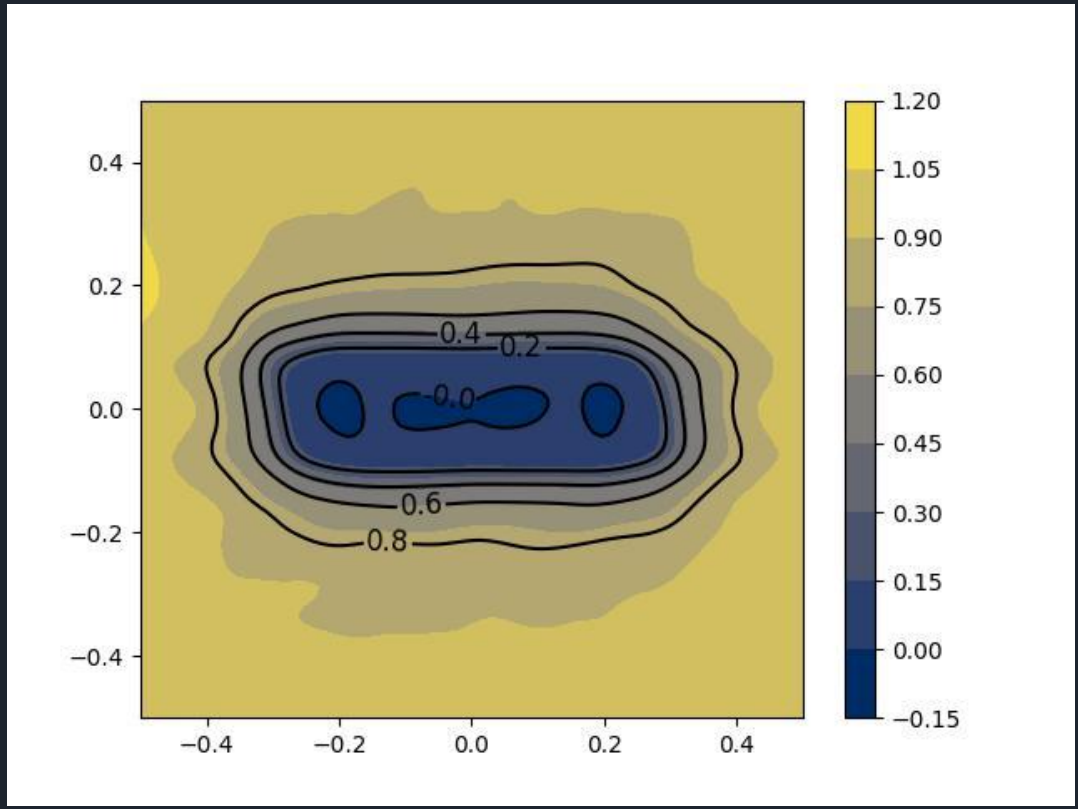
0.4
−0.4
−0.2
0.0
0.2
0.4
1.20
1.05
0.90
0.75
0.60
0.45
0.30
0.15
0.00
−0.15

k=10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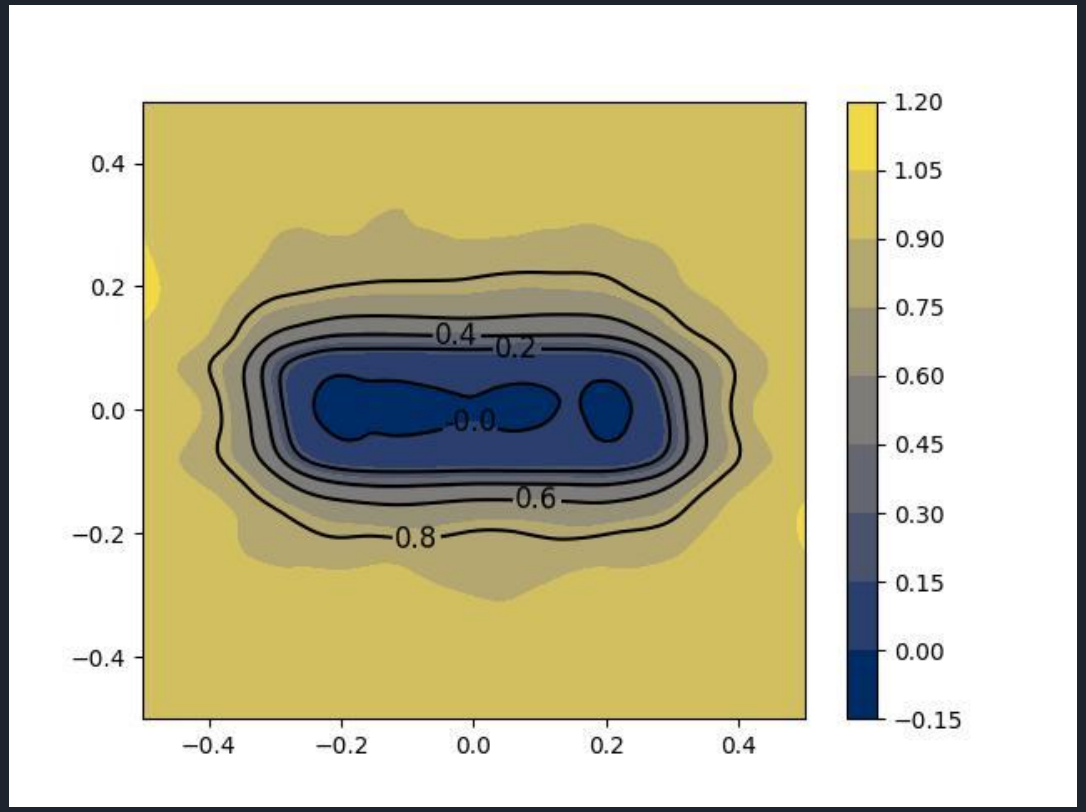
0.4
0.2
0.0
0.6
0.8
1.20
1.05
0.90
0.75
0.60
0.45
0.30
0.15
0.00
−0.15

k=11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0.4
0.2
0.0
0.6
0.8
1.20
1.05
0.90
0.75
0.60
0.45
0.30
0.15
0.00
−0.15