APPLICATIONS OF SINGULARITY THEORY TO OPTIMIZATION

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1. Lecture 1

In this lecture I will give a few examples of optimization problems, discuss the notion of algebraic degree of optimization, and introduce several tools from Singularity theory which will help us solve such problems.

2. Lecture 2

This lecture will be devoted to various facets of the nearest point problem for algebraic models. I will define and compute the Euclidean distance degree [2] and discuss an application to the triangulation problem in computer vision [4].

3. Lecture 3

In this lecture I will introduce the maximum likelihood degree [1] and its variants (bidegrees and sectional degrees), and I will discuss their computation [5] in relation to the Huh-Sturmfels involution conjecture [3].

References

[1] Catanese, F., Hosten, S., Khetan, A., Sturmfels, B., *The maximum likelihood degree*, Amer. J. Math. 128 (2006), no. 3, 671–697.

[2] Draisma, J., Horobeţ, E., Ottaviani, G., Sturmfels, B., Thomas, R., *The Euclidean distance degree of an algebraic variety.*Found. Comput. Math. 16 (2016), no. 1, 99–149.

[3] Huh, J., Sturmfels, B., *Likelihood geometry*, Combinatorial algebraic geometry, Lecture Notes in Math., vol. 2108, 63–117, Springer, Cham, 2014.

[4] Maxim, L., Rodriguez, J., Wang, B., *Euclidean distance degree of the multiview variety.* SIAM J. Appl. Algebra Geom. 4 (2020), no. 1, 28–48.

[5] Maxim, L., Rodriguez, J., Wang, B., Wu, L., *Logarithmic cotangent bundles, Chern-Mather classes, and the Huh-Sturmfels Involution conjecture*, arXiv:2202.00554.

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