Fall 2019, STT 997 Advanced Topics in Statistics: Advanced topics in nonparametric curve estimation

Time: M-W-F, 10:20–11:10 am	**Place:** C506 Wells Hall
Instructor: Luda Sakhanenko	**Office:** C441 Wells Hall
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Office Hours: Tu 9:10-10:10 am	or by appointment

Website: http://stt.msu.edu/Academics/ClassPages/ **Prerequisites:** STT 872

Description of the course: The methods of nonparametric curve estimation allow to analyze data under general models without too many restrictions. They are widely used in many scientific fields such as econometrics, biomedical research, engineering. We will be interested in estimation of densities, regression functions, signals in noisy media, integral curves, and the derivatives of these functions [1, 2].

We will discuss several estimation methods such as kernel smoothing, orthogonal series estimation, spline approximation, and neural networks. Then we will study classical results for them, such as conditions for large sample asymptotics, optimal rates of convergence, small sample behavior.

We will also introduce functional data analysis setting, main limit theorems, functional regression models [3, 4].

We will finish the course with a combination of nonparametric density estimation and functional data analysis as in [5]. If time permits, we will discuss recent advances on how to choose smoothing parameters, how to do adaptive estimation, how to construct simultaneous confidence bands.

Format of the course: Lectures on the topics listed above will be given for the first 13-14 weeks of the course. It will be a study of various areas in nonparametric curve estimation. The last 1-2 weeks of the course will involve students' presentations. Students are required to read journal papers related to the course topics. The list of papers will be provided by the instructor. All students will be asked to present their assigned articles in the class. Homework assignments will be given throughout the course. The grade will be based on attendance, the homeworks and the class presentation. The following grade scale will be used: 100-85% for 4.0, 85-75% for 3.5, 75-65% for 3.0, 65-60% for 2.5.

* Instructor reserves the right to change the syllabus as circumstances necessitate, it is student's responsibility to keep up with any changed policies announced in class.

References

[1] Efromovich, S. *Nonparametric curve estimation* (1999) Springer–Verlag, New York.

[2] Devroye, L., Lugosi, G. *Combinatorial methods in Density estimation* (2001) Springer Series in Statistics.

[3] Ferrety, F., Vieu, P. *Nonparametric Functional Data Analysis* (2006) Springer Series in Statistics.

[4] Kokoszka, P., Reimherr, M. *Intrroduction to Functional Data Analysis* (2017) CRC Press.

[5] Delaigle, A. and Hall, P. (2010). Defining probability density for a distribution of random functions. *The Annals of Statistics*, 38(2):1171–1193.