

SOME POSSIBLE UNDERGRADUATE RESEARCH PROJECTS

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Topic 1: Study the Riemann zeta function:

Study some first properties of the Riemann zeta function.

Main reference: H. M. Edwards, Riemann's zeta function, 1974

Can go deeper into some density results for zeros of the Riemann xi function on the critical line. Can be linked to Topic 3.

Topic 2: (Stochastic, Backtracking) gradient descent:

Study some methods to solve optimization problem, with or without stochastic setting, and with boosting methods like Armijo's Gradient descent. Will do in deep research on some simple functions, like quadratic functions.

First reference: A. Nemirovski et al, Robust stochastic approximation approach to stochastic programming, SIAM J. Optimization, Vol 19, no 4, pp. 1574-1609

Topic 3: Newton-type method to find roots of polynomials:

Will study the behaviour of Newton-type method to find roots of a polynomial $P(z)=0$ in 1 complex variable. Depending on progress, can also study the more general case of a meromorphic function (some connections to Topic 1).

First reference: T. T. Truong et al, A fast and simple modification of Newton's method avoiding saddle points, Journal of Optimization theory and applications, vol 199, pp. 805-830, 2023.

Topic 4: (Pre)images of polynomial maps:

Will study theoretical properties and algorithms to check/construct certain properties for (pre)images of polynomial maps.

Main references:

Viktor Balch Barth and Tuyen Trung Truong, Images of dominant endomorphisms of affine space, published in Communications in Algebra.

Tuyen Trung Truong, On the properness of polynomial selfmaps, accepted in Vietnam Journal of Mathematics. Preprints: arXiv:2004.03309 and arXiv:2005.02260