

The programme “Discretization and recovery in high-dimensional spaces”, 1-26 July 2024, was a follow-up meeting to the six-month programme “Approximation, sampling and compression in data science” held at the Isaac Newton Institute in January-June 2019.

The main goal of the programme was to discuss theoretical aspects of the fundamental methods used in economical data representation. These methods are widely applied to problems of big data. Our discussion was focused on recent progress in development and study of new methods of discretization of continuous problems, which is aimed at practical applications in sparse data representation. It is known that one of the successful ways to attack many modern problems in approximation theory, computer science, and numerical analysis is to discretize them. This is in particular important in numerical analysis where the problem of discretization of a given integral norm of functions from a finite dimensional subspace arises in a natural way.

Activities of the one-month long programme “Discretization and recovery in high-dimensional spaces” were structured around research in clusters, a regular seminar (2 seminars and 4 talks per week), and the workshop “Multivariate approximation, discretization, and sampling recovery”. In addition to that, open problem sessions took place.

The programme and the workshop attracted well over 75 participants, coming from diverse areas of pure and applied mathematics such as approximation theory, harmonic analysis, functional analysis, signal processing, machine learning, optimization, etc.

The programme’s scientific achievements are multifaceted. On one hand, participants made significant progress in addressing long standing problems in classical approximation theory, including sampling, discretization, and polynomial inequalities. On the other hand, new and promising directions emerged, particularly in multivariate approximation problems where traditional methods fall short, such as in nonlinear approximation. For instance, convergence, rate of convergence, and stability of greedy-type algorithms, which are important in practical applications, were discussed from the point of view of their applications in sampling recovery.

The programme also garnered strong interest from early-career researchers, who were active participants throughout. The Institute hosted mathematicians from various countries, including Armenia, China, India, Kazakhstan, thereby advancing the programme’s goal of fostering international collaboration among leading mathematical institutions. The facilities of the INI and the INI administrative support were at a high level.

This was fruitful and productive teamwork that can be used in the future programmes.