

## Research project and supervisory team

<b>Supervisory Team</b>	Lead supervisor: <a href="#">Elio Espejo</a> Co-supervisors: <a href="#">Daniele Garrisi</a> and <a href="#">Hayk Mikayelyan</a>
<b>Short introduction &amp; description of research project</b>	<p><b>Partial Differential Equations Applied to Biomedical Data Analysis</b></p> <p><b>Introduction</b></p> <p>Imagine a revolutionary approach where elegant mathematical models originally designed to describe how cells organize themselves in living organisms are repurposed to tackle one of the most challenging problems in modern data science: clustering and organizing vast biomedical datasets.</p> <p><b>Description of research</b></p> <p>This interdisciplinary project adapts the use of parabolic partial differential equations—a mathematical tool that has successfully described how cells form patterns through chemical attraction—to create an innovative clustering algorithm with solid mathematical foundations. Unlike conventional machine learning approaches that often function as "black boxes," our PDE-based method offers both rigorous mathematical guarantees and interpretable results.</p> <p><b>The PhD candidate will:</b></p> <ul style="list-style-type: none"> <li>- Construct and analyze systems of partial differential equations describing different adaptive sensitivity mechanisms specifically designed for data clustering.</li> <li>- Establish theoretical foundations, including well-posedness, stability analysis, and pattern formation guarantees</li> <li>- Implement efficient numerical methods for solving the system in high-dimensional spaces</li> <li>- Apply the framework to challenging biomedical applications, including medical image segmentation</li> </ul> <p>This research sits at the exciting intersection of applied mathematics, mathematical biology, and data science, offering a unique opportunity to contribute to both theoretical mathematics and practical applications in healthcare. The ideal candidate will have a strong mathematical background, particularly in analysis and differential equations, with interests in mathematical modeling and computational methods. Programming experience is desirable but not essential, as these skills can be developed during the program. Join us in bridging the gap between mathematical biology and modern data science!</p>
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