

## Percorso Autonomo Autorizzato

Title (Titolo)	<b>MODELING AND DATA ANALYSIS</b>
Chief (Referente responsabile)	(DMAT, PoliMi): prof. Laura M. Sangalli
Supporting Coordinators (Altri referenti)	(DMAT, PoliMi): prof. Luca Formaggia; prof. Piercesare Secchi
Scientific collaborations and partnerships (Collaborazioni scientifiche nazionali ed internazionali)	<ul style="list-style-type: none"> <li>• EPFL École Polytechnique Fédérale de Lausanne, Switzerland</li> <li>• University of Cambridge, UK</li> </ul>
Description and goals (Descrizione ed obiettivi)	<p>Data Science is a multidisciplinary field, embracing statistics, mathematics, information and computer science. Within this domain, the program on “Modeling and Data Analysis” focuses on uncertainty quantification, an emerging and fast growing area in applied mathematics, at the interface among mathematical modeling, scientific computing and statistics. It has nowadays become clear that the understanding of uncertainty and variability is fundamental when dealing with complex problems in engineering (e.g., in the automotive, naval, aircraft and space sectors) and in sciences (e.g., in the life sciences, geosciences, climatology and weather forecasting).</p> <p>The <i>Dipartimento di Matematica</i> at Politecnico di Milano offers a unique opportunity to specialize in this area, thanks to its strong expertise in numerical analysis, scientific computing and statistics, and the synergy among these research areas, with consolidated experiences in interdisciplinary research programs.</p>
Study Plan (Piano di studi)	<p>This program is available to students enrolled in both Majors (PSPA) in <i>Computational Science and Engineering</i> and in <i>Applied Statistics</i>. The program profits from courses offered in both majors, such as “Advanced partial differential equations”, “Numerical analysis for partial differential equations” and “Advanced programming for scientific computing” from the major in Computational Sciences and Engineering, as well as “Applied statistics” and “Bayesian statistics” from the major in Applied Statistics.</p> <p>Various topics will be available for students interested in developing joint projects for the courses of “Numerical analysis for partial differential equations”, “Advanced programming for scientific computing”, “Applied statistics” and “Bayesian statistics”. Likewise, thesis may be co-supervised by professors in numerical analysis and in statistics.</p>
Past MSc theses (Alcune Tesi discusse)	<ul style="list-style-type: none"> <li>• G. Mazza (Ing. Mtm.), <i>Regressione con regolarizzazioni differenziali per dati spazio-temporali, con applicazione all'analisi della produzione di rifiuti urbani nella provincia di Venezia</i>, 2015</li> <li>• E. Lila (Ing. Mtm.), <i>Smooth principal component analysis over two dimensional manifolds with application to Neuroimaging</i>, 2014</li> <li>• N. Tarabelloni (Ing. Mtm.), <i>Metodi numerici e statistici per la simulazione e validazione di ECG</i>, 2013</li> <li>• M. Wilhelm (EPFL), <i>Generalized spatial regression with differential penalization</i>, 2013</li> </ul>
Available subjects for a MSc thesis (Tesi disponibili)	<ul style="list-style-type: none"> <li>• <i>Numerical and Statistical techniques for uncertainty quantification</i> (in collaboration with École Polytechnique Fédérale de Lausanne)</li> <li>• <i>Numerical and Statistical techniques for the analysis of neuroimaging data associated with neuronal activity in the cerebral cortex</i> (in collaboration with University of Cambridge)</li> <li>• Various other thesis projects, possibly with applications in life-sciences, geosciences and</li> </ul>

	engineering; some of these will be jointly supervised by professors of numerical analysis and statistics.
<b>Job opportunities (Sbocchi lavorativi)</b>	All of the job opportunities for the Majors in Computational Sciences for Engineering and in Applied Statistics. The proposed program moreover offers a specific and highly qualified preparation to work as data scientist and modeler in research and development centers in the engineering (naval, automotive, aircraft and space), energy, physical sciences, geosciences and life sciences sectors, centers for weather forecasting, climatology and environment, consulting companies, companies involved in the analysis of complex data.