



Figure 1: A schematic view of Algorithms and Complexity

# 1 Algorithms and Complexity

## 1.1 Overview

The area of *Algorithms and Complexity Theory* (often also called *Theoretical Computer Science* or *Foundations*) aims to understand fundamental problems that lie at the heart of important tasks in many different areas of Computer Science, and through this understanding to develop algorithms and models that have broad and lasting impact. Key topics include Data Structures, Approximation Algorithms, Complexity Theory, Cryptography, Computational Geometry, Scientific Computing, Network Algorithms, Machine Learning Theory, Online Algorithms, and Computational Biology.

While the above is only a partial list, it points out the great breadth of this area. In fact, one might naturally ask what such topics as cryptography and machine learning have to do with each other. The answer is that by isolating and extracting many of the key mathematical challenges in each topic, one finds a great number of connections and issues in common, as well as a core of powerful analysis techniques. We illustrate our view of Algorithms and Complexity Theory in Figure 1. Individual research projects and individual researchers may lie more in the center or more along one or several spokes, but the overall aim is to pull in key problems and issues, to develop and push out new algorithms and models, to build up our core understanding of computational problems, and to establish useful connections between seemingly disparate topics and objectives.