I will talk about algorithms for three types of large data sets: centralized, distributed, and visual. The focus will be on a classical algorithmic problem from each type, and the role of geometry in the recent progress on these problems.

1) Binary search trees (BSTs) with rotations can adapt to various kinds of structure in search sequences, achieving amortized access times substantially better than the $O(\log n)$ worst-case guarantee. A famous example of such a BST is the Splay tree invented by Tarjan and Sleator in 1985, which gave rise to the dynamic optimality conjecture, one of the most important open problems in data structures for online algorithms. After stating the conjecture, I will mention its geometric counterpart, and describe some of the recent progress, most notably the resolution of the thirty-year-old traversal conjecture.

2) Load balancing on networks is a long standing open problem, which is already NP-hard in the centralized setting, leaving very little hope for an efficient distributed algorithm. Even for the simple case of sensors distributed uniformly in some planar domain, no efficient approximation algorithm was known. I will describe an algorithm that routes using the medial axis of the domain, that turns out to be the first constant factor approximation for load balancing in this setting.

3) The study of conformal (angle-preserving) maps forms the basis of complex analysis, and recently conformal geometry has found many applications in computer graphics, vision and medical imaging. However, given two surfaces and some boundary constraints, in general it is not possible to find a conformal map between them. One wants a map that minimizes the maximum angular distortion. Such maps are called Teichmuller maps, and although their existence was proved by Teichmuller in the 1940s, no constructive procedure was known until now. I will briefly describe an algorithm for computing such maps between polygons.

Bio: Mayank Goswami is a researcher at the Max-Planck Institute for Informatics in Germany, hosted by Prof. Kurt Mehlhorn. He completed his Bachelors in pure mathematics from the Indian Statistical Institute in 2007, and received his doctorate in applied mathematics and statistics (operations research track) from Stony Brook University in 2013 under the supervision of Prof. Joseph S. B. Mitchell. His main research areas are algorithms for databases and external memory models, networks, computational geometry and its applications to computer graphics and vision.