COMPILED AND EDITED BY THE **CONNECT TEAM** BASED ON INPUT FROM THE FEATURED **RESEARCHERS**

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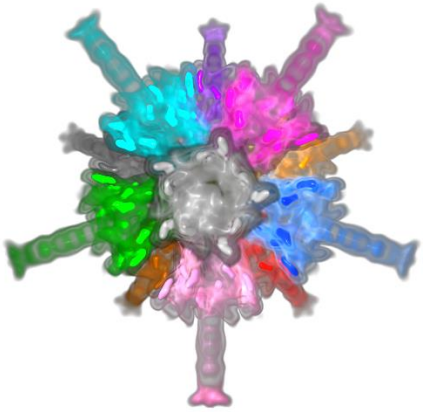
Visualizing data

Scientific data—such as those arising from imaging devices and computational experiments in science and engineering disciplines—is increasingly becoming larger in size and richer in its features. A deeper understanding of such data plays a fundamental role in the discovery of knowledge. In their research, Natarajan and his team employ an approach called feature-directed data visualization where the data is first processed to obtain abstract representations, which in turn can be visualized for interactive exploration. They have demonstrated the

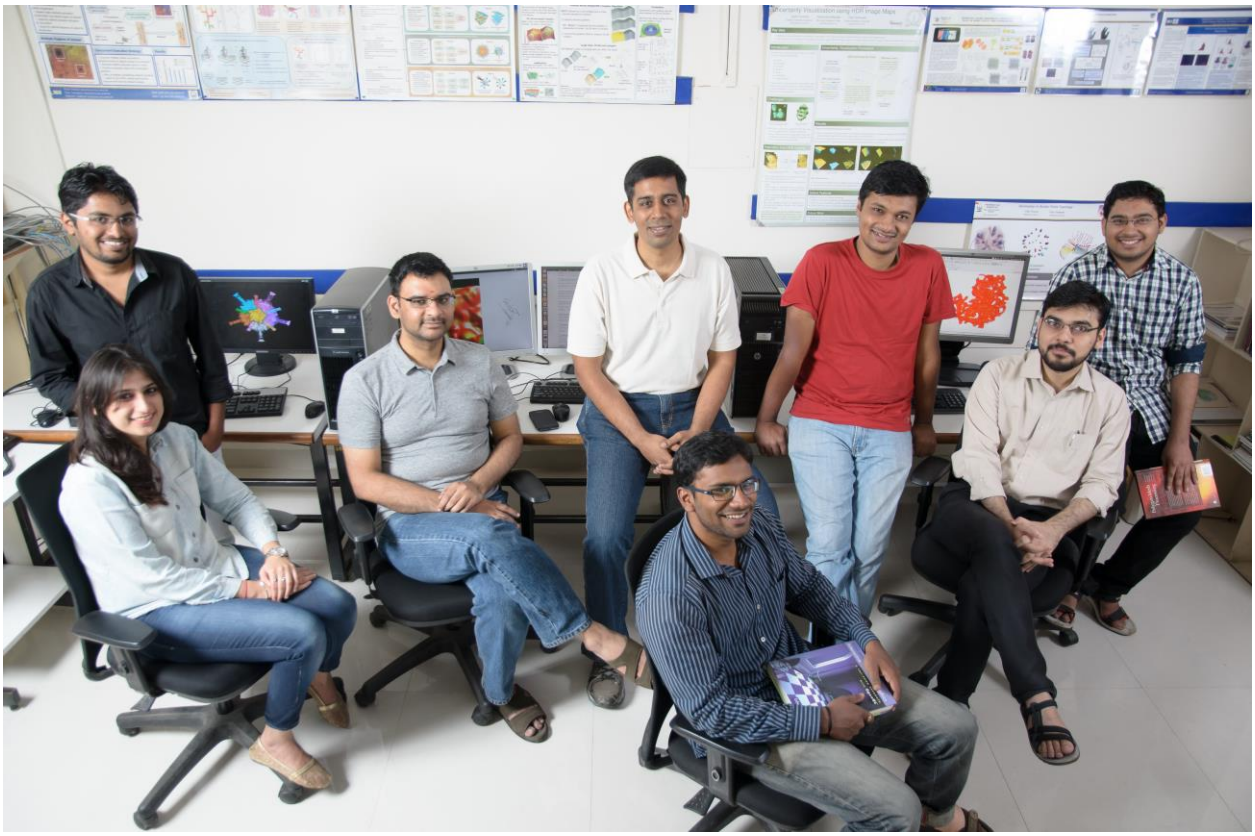
effectiveness of such feature-directed and knowledge-assisted visualization methods to data from various disciplines like weather and climate science, molecular biology, and cosmology.

One problem that has received Natarjan's special attention is the study of the role of symmetry in understanding the structure as well as the physical properties of both natural and man-made objects. His lab has modeled the problem of symmetry identification for the first time in a novel feature-aware manner, where the symmetric repeats are restricted to features of interest in the data. They have also designed computationally efficient algorithms to identify symmetric regions within volumetric data that may arise from 3D imaging devices or from simulations. The automatic detection of symmetry is a computationally challenging problem because it necessitates a search over all possible regions within the volume and a search over all possible symmetries. Moreover, real life data sets never exhibit perfect symmetry. This introduces additional challenges in determining symmetry in an approximate senseas well as in handling noise and in identifying missing parts within symmetric regions in the data.

Natarajan and his team have shown that symmetry information helps enhance traditional visualization methods. They have also demonstrated applications to query-driven exploration of feature-rich data where displaying the entire data is neither efficient nor useful. They believe that their methods for symmetry detection will open new frontiers in analyzing structural similarity of scientific data.



Visualization of the dodecahedral symmetric structure of the human adenovirus. The symmetric patterns were computed automatically from cryo-electron microscopy data and used to highlight interesting features in a visualization (COURTESY: VIJAY NATARAJAN)



Natarajan with his team (MANOJ SUDHAKARAN)