Strategic research is at the heart of big data endeavors at Georgia Tech. Emphasizing personal and global applications, as well as core industry solutions, our researchers define the future role of big data technologies in society. The study of basic scientific and engineering problems is central to our work, but equally important is the integration of innovation and discoveries into real-world systems and applications. The exceptionally high quality of our programs, faculty, and laboratories positions Georgia Tech as a global leader in big data research.

Institute for Data Engineering and Science
College of Computing professors Srinivas Aluru and Dana Randall are co-directors of the strategic initiative to leverage Georgia Tech’s research expertise, resources, and partnerships to develop new methods that transform data into value by analyzing large and complex data sets. Georgia Tech is poised to lead Big Data research and economic development with the construction of a state of the art high-rise facility in Tech Square. The new building, scheduled to open in early 2018, will feature more than 750,000 square feet of office and laboratory space, and an 80,000-square-foot data center for advanced cyber infrastructure and national data repositories.

Big Data Innovation Hub for the South Region
To accelerate the translation of big data into economic growth and end-user impact, Srinivas Aluru and collaborators at the University of North Carolina at Chapel Hill created the South Big Data Regional Innovation Hub (South BD Hub). It is composed of academic institutions from 16 southern states and the District of Columbia, in partnership with a wide swath of collaborators from industry, government, and nonprofit organizations. Funded by NSF, it will promote innovation, collaboration, and provide essential workforce training. Certain science challenges will be addressed by regional hubs with broad problems spanning the national hub network.
SOFTWARE CHALLENGES OF HETEROGENEOUS ARCHITECTURES
Sudhakar Yalamanchili, professor in the School of Electrical and Computer Engineering, develops new scalable modeling and simulation infrastructures to support research efforts in many core architectures, and studies the integration of interconnection networks and memory systems. In the context of heterogeneous computing, he focuses on GPU accelerators and supporting execution environments. He also investigates the impact of the physics of operation (e.g., thermal) on system performance and driving architecture operation and design.

PROBING OUR UNIVERSE IN GRAVITATIONAL WAVES
Deirdre Shoemaker, professor in the School of Physics, studies the gravitational interactions of compact binaries, interacting double black holes that emit gravitational radiation. She also predicts and tests the theory of relativity in the strong-field regime. As gravitational physics morphs into an observation-driven field, populated by data from detectors like the Laser Interferometer Gravitational-wave Observatory (LIGO), the field of numerical relativity is solving the binary black hole problem. There is now a unique opportunity to probe our universe in gravitational waves, revealing the strong-field interactions both theoretically and experimentally.

EXPERIMENTAL SYSTEMS RESEARCH
Senior Research Scientist Ada Gavrilovska of the School of Computer Science, is involved in large-scale collaborative projects on high-performance systems software, including DOE-supported research for exascale computing. Her project portfolio is broad, from developing new OS mechanisms and abstractions to dealing with future memory technologies. She helps redesign fault tolerance methods in light of new hardware features, and develop methods for managing performance and machine efficiency for collocated workloads. Recently, she’s worked on compiler-assisted resource management methods with School of Computer Science Professor Santosh Pande and others.

SIMULATING THE BEHAVIOR OF TURBULENT FLOWS
Professor P.K. Yeung of The Daniel Guggenheim School of Aerospace Engineering uses high-resolution direct numerical simulations to study the fundamental behavior of turbulent fluid flow using large-scale computation. His work examines turbulent mixing and dispersion at the highest Reynolds number possible with available computing. He also develops algorithms for scientific computing to allow the largest simulations possible. Current simulations are run on NSF and the DOE supported systems with tens or hundreds of thousands of parallel processors. Results from a large computation performed on the Blue Waters (NSF Track 1) supercomputer were recently reported in the Proceedings of the National Academy of Sciences.

TOOLS AND TECHNIQUES FOR PARALLEL MACHINES
Rich Vuduc, associate professor in the School of Computational Science and Engineering, develops the algorithmic and software techniques that underlie HPC to make fast code for supercomputers, and also power- and energy-efficient code for all computers. His HPC Garage is at the forefront of developing new analytical models and experiments that explain the relationships and tradeoffs among the time, energy, and power needed by an algorithm, as well as how to save all three at the level of algorithms, data structures, and software.

COMPUTATIONAL FLUID AND COMBUSTION DYNAMICS
Professor Suresh Menon in the The Daniel Guggenheim School of Aerospace Engineering is a world-renowned expert in large-eddy simulation of turbulent reacting, and non-reacting flows. He has developed unique multiscale parallel simulation capabilities to study pollutant formation, ozone depletion in high-altitude aircraft jet plumes and combustion in gas turbine and ramjet engines. Menon has been a principal investigator for a wide range of research projects funded by NASA, Air Force, Office of Naval Research, and Department of Energy.