Problem:

The use of physics-based numerical models has been an emerging paradigm in the analysis of remote sensing data and the development of exploitation algorithms. Iterative computing of these models, however, has been a restricting factor in this process.

We present several remote sensing research case studies conducted by the Digital Imaging and Remote Sensing Laboratory at RIT that have been successfully addressed by a High Throughput Computing (HTC) system and highlight the computational gains realized by this HTC framework using several hundred idle workstations.

Case Studies:

- **MODTRAN LookUp Table Generation (FORTRAN)**
  - Database for Atmospheric Compensation
  - Target Detection Algorithms
  - 2200 8-stream DISORT RUNS (0.4-2.5 microns)
  - CONDOR Run Times vs. Single Workstation Estimate
  - 2 hours vs. 15 Days

- **LIDAR Point Cloud Analysis (IDL)**
  - LIDAR geometrically constrains hyperspectral radiance
  - LIDAR data shadow & sky map
  - Improves physics-based target detection.
  - 3 hours vs. 5 Days (shadow map)
  - 35 hours vs. 50 days (sky map)

- **Water Constituent Spectral Matching (ENVI/IDL)**
  - Simultaneous atmospheric compensation and water constituent concentration retrieval
  - Hyperspectral image processed against spectral library of 100,000+ spectral entries
  - 20 hours vs. 20+ Days

- **Sparse Aperture Image Quality Analysis (IDL & MATLAB)**
  - Simulation optical element errors on spectral image quality
  - Varying amounts of noise, aberrations, and bandwidths are modeled.
  - Executed on a 100+ CPU SMP (symmetric multiprocessing) cluster
  - 25 hours vs. 15 Days

Summary:

The Condor system has consistently improved process runtimes close to an order of magnitude making physics-based approaches tractable. The ability for Condor to take several problems implemented in a variety of environments is a major enabling technology for algorithm development and remote sensing data analysis.