High Throughput Model Predictive Controller For Heterogeneous Many Core Systems

AzTE Case # M14-121P

Inventors

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Background

Medical applications such as radiotherapy, MRI, and CT scans use high performance graphics processing units (GPUs) to reconstruct high-resolution images. Real time medical control systems (RTMCSes) connect single or multiple patients, who are monitored by one or more medical devices, to a central control unit that regulates patient conditions and administers treatment accordingly. Parallelism within the data of a single patient, as well as between multiple patients, has prompted the use of GPUs within RTMCSes. However, given the high percentage of serial computing in RTMCSes, GPUs fail to meet the throughput requirements needed for reliably responsive treatment. Additionally, poor memory organization causes the processors to spend more time communicating rather than processing useful information.

Invention Description

Researchers at ASU have developed an algorithm that integrates parallel computation with serial processing to optimize communication between GPUs/coprocessors and central processor units (CPUs) and mitigate delays due to communication overhead. The algorithm runs a serial-coded Pharmacokinetic model through the CPU and a parallel-coded spatiotemporal model through either a GPU or a Many Integrated Core (MIC) coprocessor. This novel heterogeneous platform provides sufficient throughput that enables a hospital's central control unit to effectively monitor and respond to many patients with various critical care needs. The algorithm is especially effective when run through Intel's i7 core CPU and Xeon Phi MIC coprocessor.

Intellectual Property Status:

Pending

Potential Applications

- Biomedical DNA Sequencing
- Graph Processing
- Medical Central Control Units
- Ray Tracing

Benefits and Advantages

- **Efficient** – Minimizes response time between physiological alert and patient treatment.
- **Powerful** – Decreases the bottlenecking due to communication overhead and serial operations, allowing the processors to handle much greater throughput.
- **Lower Costs** – Reduces the amount of control units needed to keep track of patient monitors and the amount energy consumed by processing.

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