A Vision for Workload Convergence in the Era of Manycore Computing

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This position paper supports the growing need of a general-purpose “analytics engine” that can enable manycore processing platforms to effectively model events, objects and concepts based on end-user input, and accessible datasets, along with an ability to iteratively refine the model in real-time. We find such processing needs at the heart of many emerging applications and services. This processing is further decomposed in terms of an integration of three fundamental compute capabilities –-recognition, mining, and synthesis (RMS). The set of RMS workloads is examined next in terms of usage, mathematical models, numerical algorithms and underlying data structures (figure below). Our analysis suggests a workload convergence which is analyzed next for its platform implications. In summary, a diversified set of emerging RMS applications from market segments like graphics, gaming, media-mining, unstructured information management, financial analytics, and interactive virtual communities presents a relatively focused, highly overlapping set of common platform challenges. A general-purpose manycore platform designed to address these challenges together has a potential for significantly enhancing user experience and programmer productivity.

Level 1: Applications				
Ad-hoc search	…	Derivative Pricing	Ray-Tracing	Computer Vision
Semantic Search	Portfolio Selection	…	Physical Simulation	…
Level 2: Mathematical Models				
Partitioning Based	…	Diffusion Models	Level Sets	Tracking &Reconstr.
Generative non-linear	Quadratic Optimization	…	Particle Systems	…
Level 3: Mathematical Techniques				
SVD	…	Interior-Point Method	Collision Detection	Path Planning
K-means	Stochastic Simulation	…	Filtering&Anti-Aliasing	…
Level 4.1: Numerical Algorithms				
Direct Solvers	Iterative Solvers	Monte Carlo Simulation	Convex Collision (V-Clip, GJK)	
Level 4.2: Numerical Primitives and Data Structures				
Sparse BLAS123	Dense BLAS123	Structured matrix operat.		
Sparcity struct. (CRS, graphs, elimination tree	Basic geometry primitives (triangle, box, convex)	Partition structures (grids, kd-tree, BVH)		