GAME AI PLANNING

Motivation

• GPGPU for the future of Game AI c,d,e
• Games use planning a,b,f,g (plans of at most 4-6 actions, for 50 bots max)
• Previous work shows encouraging speed-up h

GOAP a-like Grounded Planning

• Instantiated actions: attack-enneny, dodge, patrol, flee, cover, ... (32 actions max)
• 64-bit integer (plan length at most 12 actions g)
• Breadth-first search for each NPC

GPU and Planning

• GPU is designed for Matrix & Vector of integers
• What integer-based representation to encode planning predicates, states and actions?
• One bit == One predicate; e.g. enemity-is-dead
• One state is 32 predicates max (32-bit integer)

Experiments

• 1GB used max on GPU
• GT 650M on Intel core i7 2.3GHz
• GTX 550Ti on core 2 duo 2.2GHz
• GTX TITAN on Xeon E5 2.7GHz

On a simple planning problem: Blocks World (3, 4 and 5 blocks)
• Random initial and goal states

References

b – Dana NAU, Yue CAO, Ammon LOTEM & Hèctor MUÑOZ-AVILA – The SHOP Planning System – AI Magazine 22(3), AAAI Press (Fall 2001)
c – William BLEWITT, Gary USHAW & Graham MORGAN – Applicability of GPGPU Computing to Real-Time AI Solutions in Games – Computational Intelligence and AI in Games (2013)
d – Alex CHAMPANDARD & Andrew RICHARDS – Massively Parallel AI on GPGPUs with OpenCL or C++ – Proceedings of the Game Developer Conference (2014)
g – Éric JACOPIN – GOAP Analytics – GDC 2015 AI Summit – March 3rd
h – Stéphane CARDON, Éric JACOPIN – CUDA Constraint Programming for AI Gaming in the Cloud – Poster at the NVIDIA GPU Technology Conference 2015

GPU planning

150 faster than CPU planning
(one breadth-first search for each NPC)

Experiments

• CPU+GPU
• Expected if only on GPU

Planning for how many NPCs per frame?

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