dTank: A neutral environment for teaching and testing agent architectures

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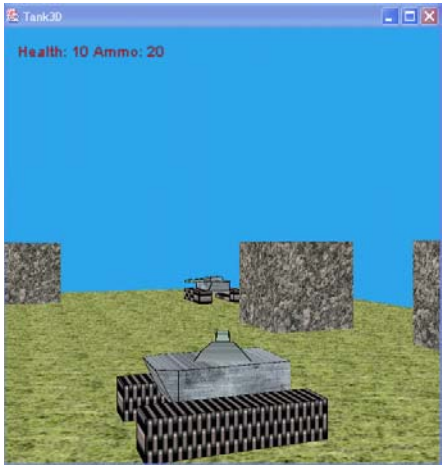


Introduction

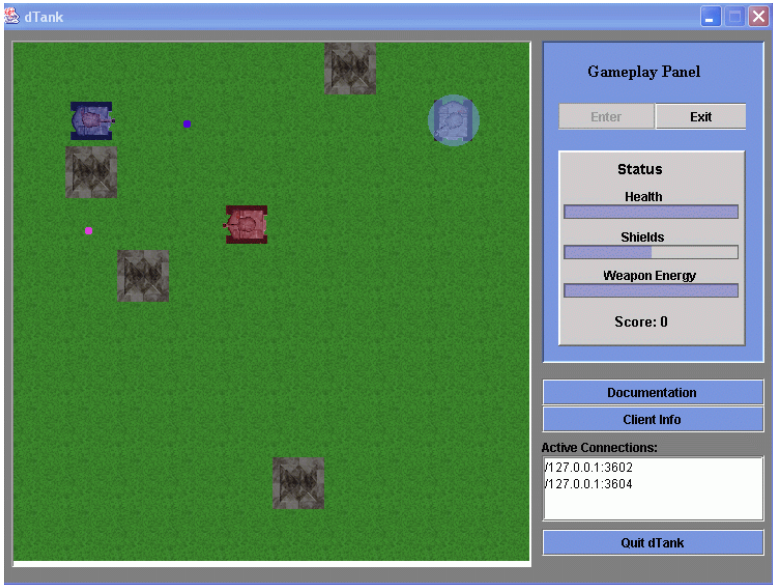
- dTank is an environment for the comparison of humans, agents, and models
- Inspired by As-sanie and Laird's Tank-Soar environment
- Light-Weight alternative to ModSAF, JSAF, OTB, etc.
- Simple enough to be used by students
- Complex enough to create interesting behavior

Overview of Presentation

- dTank's Design, why agents and humans can be easily compared
- Architectures supported by dTank
- Data Logging in dTank
- Summary and Future of dTank

Features of dTank’s Design

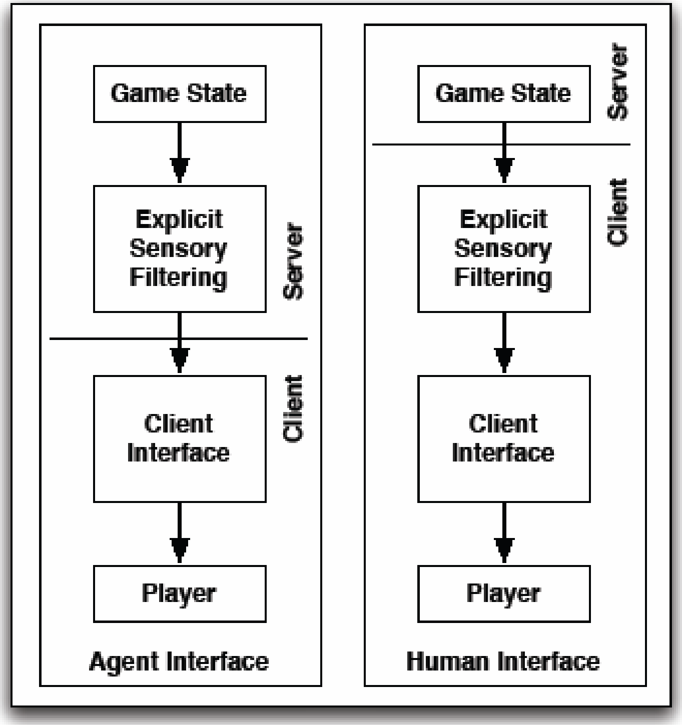
- Client-Server Architecture
- Java
- Socket Communications
- Sensory Filtering
- Logging
- Easy to Edit Maps
- Variable Board Size

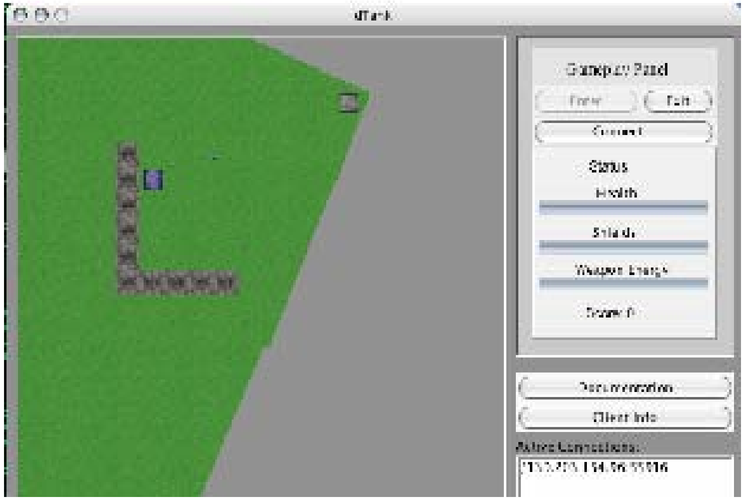


Score: 0

Active Connections:
/127.0.0.1:3602
/127.0.0.1:3604

Sensory Filtering





Architectures supported by dTank

- Java
- Jess
- Soar
- Herbal
- CAST
- ACT-R
- Jack

Development Times for some actors

- Java
  - Five Man-Hours
  - Took advantage of java objects designed to support dTank agents
- Jess
  - One Man-Hour
  - Does not assume automatic handling of implicit trigonometric equations
- Soar
  - Three Man-Hours, by the original dTank developer

Data Logging in dTank

- Logging allows painless capture of human and agent data
- Conversion software transforms dTank native logs, which include input and output, into CaDaDis logs (📖 Tor, Ritter, Haynes & Cohen, 2004)
- Software also summarizes actions taken for easy overall analysis
- CaDaDis builds on Vista (📖 Taylor, Jones, Goldstein & Frederiksen, 2002) and creates graphical sequence logs.
- This has been used to compare a novice and several different agents built in different architectures for strategy similarity (📖 Morgan, Ritter, Schenck, Stevenson, & Cohen, 2005)

Overview of Attempted Actions of All Actors, a sample

- Five Minute period for all agents and players

Actor	Fire	Rotate	Move	Turn-CC[1]	Turn-C[2]
Participant	350	569	529	42	8
JavaTank	693	193	310	35	38
JessTank	39	91	202	100	62
SoarTank	316	90	93	62	69

[1] Turn Counter-Clockwise

[2] Turn Clockwise

Win/Lose Ratio in 1 on 1 Duels with a non-logging JavaTank Agent

Actor	Win	Lose
Participant	17	15
Java (Logging)	4	8
Jess	0	10
Soar	4	8

Architectural Comparisons in dTank

- Proved useful so far.
- CAST and Soar teamwork behavior compared (📖 Sun, Fan, Ritter & Yen, 2004)
- More planned in the future between:
  - Error-Soar
  - ACT-R
  - Jack
  - COJACK

Gold Nuggets

- A useful teaching environment (3 universities, 100+ Undergraduates) (📖 Cohen, 2005; 📖 Morgan, Ritter, Haynes & Cohen, 2005)
- Useful architectural comparisons
- Broad range of behaviors possible, not limited to adversarial relationships between agents.

Lumps of Coal

- dTank’s Soar interface not compatible with 8.6
- Resource-heavy for a Java GUI program
- Current implementation difficult to scale up for more vehicle and terrain types, etc. (but revision in process)

dTank’s Future

- Architectural refactoring to support increasing complexity
- v8.6 Compliance
- More platforms w/ more example models
- Round-Robin battle formats
- Comparison of agents in Jack and COJACK

References

- Cohen, M. A. (2005). Teaching agent programming using custom environments and Jess. AISB Quarterly, 120(Spring), 4.
- 🕮 Councill, I.G., G.P. Morgan, and F.E. Ritter. (2004). dTank: A competitive environment for distributed agents: Applied Cognitive Science Lab, School of Information Sciences and Technology, Penn State.
- 🕮 Morgan, G. P., Haynes, S., Ritter, F. E., & Cohen, M. (2005). Increasing efficiency of the development of user models. In *Proceedings of the 2005 Systems and Information Engineering Design Symposium.* E. J. Bass, (ed). IEEE and Department of Systems and Information Engineering, University of Virginia: Charlottesville, VA.
- 🕮 Morgan, G. P., Ritter, F. E., Stevenson, W. E., Schenck, I. N., & Cohen, M. A. (2005). dTank: An environment for architectural comparisons of competitive agents. In L. Allender & T. Kelley (Eds.), Proceedings of the 14th Conference on Behavior Representation in Modeling and Simulation. 133-140. 05-BRIMS-043. Orlando, FL: U. of Central Florida.
- Taylor, G., Jones, R. M., Goldstein, M., & Frederiksen, R. (2002). VISTA: A generic toolkit for visualizing agent behavior. In Proceedings of the 11th Computer Generated Forces Conference. 29-40, 02-CGF-044. Orlando, FL: U. of Central Florida.
- 🕮 Tor, K., Haynes, S. R., Ritter, F. E., Cohen, M. A. (2004). Categorical data displays generated from three cognitive architectures illustrate their behavior. In Proceedings of the International Conference on Cognitive Modeling. 302-307. Mahwah, NJ: Lawrence Erlbaum.
- 🕮 Sun, S., Councill, I., Fan, X., Ritter, F. E., & Yen, J. (2004). Comparing teamwork modeling in an empirical approach. In Proceedings of the Sixth International Conference on Cognitive Modeling. 388-389. Mahwah, NJ: Lawrence Erlbaum.