CHI Systems Inc.
an OSI Geospatial company

Speech-Enabled Synthetic Teammates

Improving Team Training with Intelligent Agents

Traditional training exercises that use real-life physical locations and human role-players are expensive, logistically complex, and hindered by limited availability – factors that impede training effectiveness. CHI Systems offers a better way to conduct team training. Through simulation-based training, speech-enabled intelligent agents, and synthetic teammates, you can create believable and realistic training scenarios that maximize your readiness with anytime, anywhere team training.

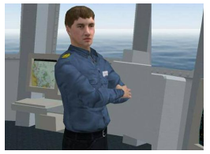
Team Training that Integrates Intelligent Agents and Speech Recognition

CHI Systems' approach to simulation-based training provides a realistic and natural means for users to interact in real time with synthetic agents. CHI makes this possible by integrating intelligent agents that encapsulate domain knowledge of team members, training mentors, and instructors with state-of-the-art speech recognition and synthesis capabilities.

The intelligent agents gather information from simulations, such as geographical position and environmental conditions, and user actions, such as button presses. The agents also detect and interpret the actions taken and the words spoken by the user in performing their role-playing and assessment roles (including measures of how accurate, appropriate, and concise a user's communications are). The agents can be deployed in a training system to guide users through a simulated mission and test their competency by intentionally making mistakes or by triggering scenario events dynamically.

CHI's speech-enabled agents have been used for military aviation, air traffic control, and cultural-familiarization training, and have been integrated with a number of commercial and open source simulation environments, such as JSAF, commercial game engines, and flight simulation software.

The Strength of a Proven Framework



Support maritime training missions

The intelligent agents leverage CHI's proven and tested iGEN® intelligent agent framework to capture domain-specific knowledge in a human cognitive model. iGEN is able to track multiple competing tasks with dynamic priorities so critical issues get proper attention. The framework is scalable so you can assign extremely lightweight agents to support many relatively simple models or a few very complex models to support complex interactive dialogue.

The intelligent agents are adapted to their simulation environment by an application programming interface (API), for gathering information and performing actions (see Figure). CHI's framework supports multiple agents that can simultaneously act as synthetic teammates to support team training and serve as instructors. In the instructor role, agents can handle multiple human participants, tracking each user's performance, status, and speech. Agents are able to communicate with each other over a distributed network via a variety of TCP/IP protocols including High Level Architecture (HLA) and the Game Networking Engine (GNE).

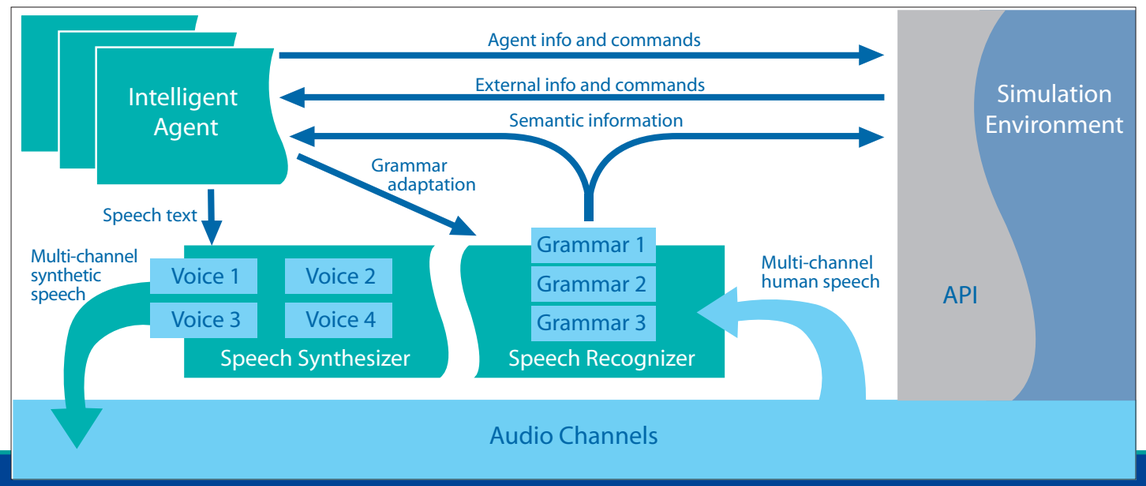
Interacting with Agents by Speech

Speech Recognition Accuracy Beyond the Baseline

CHI's intelligent agents do not require preliminary training for specific voices; they can recognize human speech by employing commercial speech recognition engines. An innovative speech recognition framework takes advantage of the latest in commercial recognition engines to achieve the highest possible recognition rate. The framework integrates CHI's intelligent agents with commercial speech recognition products. The agents control and adapt grammar dynamically based on their knowledge of the current status of the training mission to increase recognition accuracy beyond the baseline achievable with conventional approaches.

Each agent holds a mental model, or blackboard, which contains a structured representation of all possible communications types (messages) and content (keywords), consistent with the current state of the speech recognition component's grammar. The blackboard and grammar work in tandem to guide speech recognition, assuring more reliable and robust interpretation. The recognition component shares its interpretation with the agents, which then apply their task knowledge to map those recognized utterances to domain-specific behavior and dialogue responses.

Speech-Enabled Agent Configuration



Speech Synthesis Options

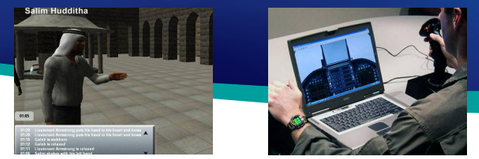
The agents' speech capabilities are adaptable to different training system requirements. Recordings of actual speech by actors or domain experts can be used to ensure an authentic training experience, complete with regional accents and distinctive inflection. The agents process the recordings in real-time to produce the required audio dynamically, based on an existing recorded vocabulary. For very broad and dynamic vocabularies, CHI's speech synthesis framework can support best-in-class commercial text-to-speech engines so you can implement speech synthesis without maintaining a corpus of recordings.

Simulate multi-pilot missions

All of CHI's speech synthesis solutions are available with radio static or mechanical noise overlaid to achieve more realism and can support the identification of synthetic agents with distinctive voices.

Voice Recording Maintenance

CHI's voice recording and management tools support distributable, remote recording and collection of audio files. In addition, a selection of fully synthetic voices is available to support a broader or open-ended vocabulary. You can incorporate either or both of these approaches in your training system.



Run synthetic teammates on PC and full-mission simulations

Dealing with Off-Topic Communications

To cope with unanticipated user communications, agents encode domain-based heuristics that enable them to accommodate the user's action while maintaining progress in the scenario. These techniques include:

- Verbally requesting that a user "say again"
- Performing a behavioral or speech action to recover from a user's error
- Inducing scenario events as a 'confederate' role-player to maintain scenario integrity
- Coaching the user with a set of possibilities applicable to the current state of the mission scenario

Extensibility

Scenario-based experiential training applications can be extended through:

- Customized scenario authoring tools that provide training administrators control over scenario events and learning objectives
- Creating new agent behaviors using the iGEN Integrated Development Environment (IDE)
- Extending the agents' task and domain knowledge to accommodate changes in tactics or procedures
- Augmenting speech recognition and speech synthesis grammars to provide a larger body of voice communications
- Inserting new agents based on changing training requirements or evaluation criteria
- Recording new audio to achieve desired voice effects, regional accents and domain-specific vocabularies and speech styles

Specifications

Supported Standards

- HLA RTI 1.3 or IEEE 1516 using the RPR FOM versions 1 or 2
- Other FOMs can be supported with modest adaptation.
- The iGEN® model framework supports both a C++ and Java API.

Hardware/Software Characteristics

- Laptops or desktops with Windows XP or Vista and the most recent distributions of Linux that use Intel or AMD processors.
- The speech-enabled agents are engineered to take advantage of multiple core and processor architectures.
- The maximum number of intelligent agents that can be run concurrently is dependent on the model complexity. We have tested up to 50 models on standard COTS hardware with no performance degradation.
- At least 1GB of RAM and a 2GHz processor
- The RAM required for speech synthesis is 50 MB per voice, and for voice recognition, 20MB.

Integration

- Integration can be achieved through HLA, using the RPR FOM, or via a C++ API.
- The API can also be adapted to support Java or Web Services.

Learn More

To learn more about simulation-based training options, contact CHI Systems at training@chisystems.com.

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