Interoperable Adaptivity and Learning Analytics for Serious Games in Image Interpretation

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Introduction & Objectives
- Adaptive Serious Games for education and training
- Artificial Intelligence (A.I.) for automatic adaptation
- Increase of learning outcome in aerial and satellite image interpretation; increase motivation (Flow)
- Interoperability for multi-/cross-system applications

Solution Approach & Concept
- Decentralized software architecture and externalized adaptivity logic ("E-Learning A.I.", ELAI)
- Minimal-invasive, bi-directional game engine adapter
  - Usage data collection (xAPI) → Learning Analytics
  - Genre-specific adaptation strategies → Adaptivity
- Usage of interoperability standards, e.g. xAPI, HLA
- Applicable to heterogeneous application scenarios and different game engines

ELAI Architecture

ELAI Controller, Tutoring Agent, Adaptivity
- Interpretation Engine to determine learner states
- Rule-based heuristics (Didactic Factors), i.e., assessing learner states and performance scores
- Learner classification based on clustering (k-means)
- Influence Engine: different adaptation strategies using Intelligent Virtual Agents (IVA), Adap. Learning Paths, etc.
- ELAI Tutoring System for Learning Analytics and manual adaptation control, e.g., adjustment of IVA helping level

Application Prototype
- Unity-based seek-and-find mapping game with ELAI-Adapter
- Dynamic Difficulty Adjustment (DDA) for dynamic image modifications, e.g., artificially generated clouding

Related Work
- ALIGN architecture for adaptive serious games
- RAGE: Realizing an Applied Gaming Eco-System
- Total Learning Architecture (TLA), ADL.gov, xAPI

Summary
- Adaptivity for serious games and computer simulations
- Concept successfully applied to Unity-based games
- Decentralized software architecture enables easy integration of other games and simulations (future work)