Machine Learning

What's Machine Learning?

Definition from Wikipedia:
   As broad subfield of Artificial Intelligence, "Machine Learning" is concerned with the development of algorithms and techniques that allow computer to "learn".

   In the Game, one Non-Character-Player can "learn", means that he can adjust his Strategy to adapt to different opponents.

Why "Machine Learning" for the Game-Industry?

- More Entertaining

- More Challenging

- Prolong the Gamelife.

Machine Learning - History and Today

- **Earliest:**
  Arthur Samuel (1901-1990) and his checker-playing program

- **For decades:** just academic research in analytical games
  e.g.
  > Morph & Morph II project headed by *Robert Levinson* at *UC Santa Cruz*.
  > SAL *written by Michael Gherrity at University of California at San Diego*

Machine Learning - History and Today (con.)

- **In recent years:** the research has been extended to the commercial games. e.g. Strategy games and RPG. but has not been used in any major games releases

- An AI Gameengine: **X-ait-Engine** by X-aitment (a spin-off of the German Research Center for Artificial Intelligence (DFKI GmbH)).
  - Training and Planning

Algorithm Types

many different Algorithms:

1. Statistical Learning
2. Dicision Tree Learning
3. PAC-Learning?
4. Induktive Logic Programming
5. Unsupervised Learning
6. Temporal-Difference Learning
7. Instance Based Learning
8. Analytical Learning
9. Combining Inductive and Analytical Learning
10. Reinforcement Learning

…

Some common algorithm types

- Knowledge-Poor Supervised Learning
  Given: A training set(1) of annotated instances
  To Induce: A hypothesis

- Knowledge-Intensive Supervised Learning
  Given: A set of Training instances + a hypothesis of target
  concept +   background knowledge
  To Induce: A modified hypothesis
            That is consistent with the domain theory & the
  training instances.

Some common algorithm types(con.)

- Unsuperived learning: Clustering
  Given: A set of unclassified instances I
          Have not any special target attribute
  To Do: Create a set of clusters for I according to their presumed
          classes.
          Clusters need not to be disjoint
          Cluster can be hierarchically related.

- reinforcement learning:
      where the algorithm learns a policy of how to act given an
observation of the world. Every action has some impact in the
environment, and the environment provides feedback that guides
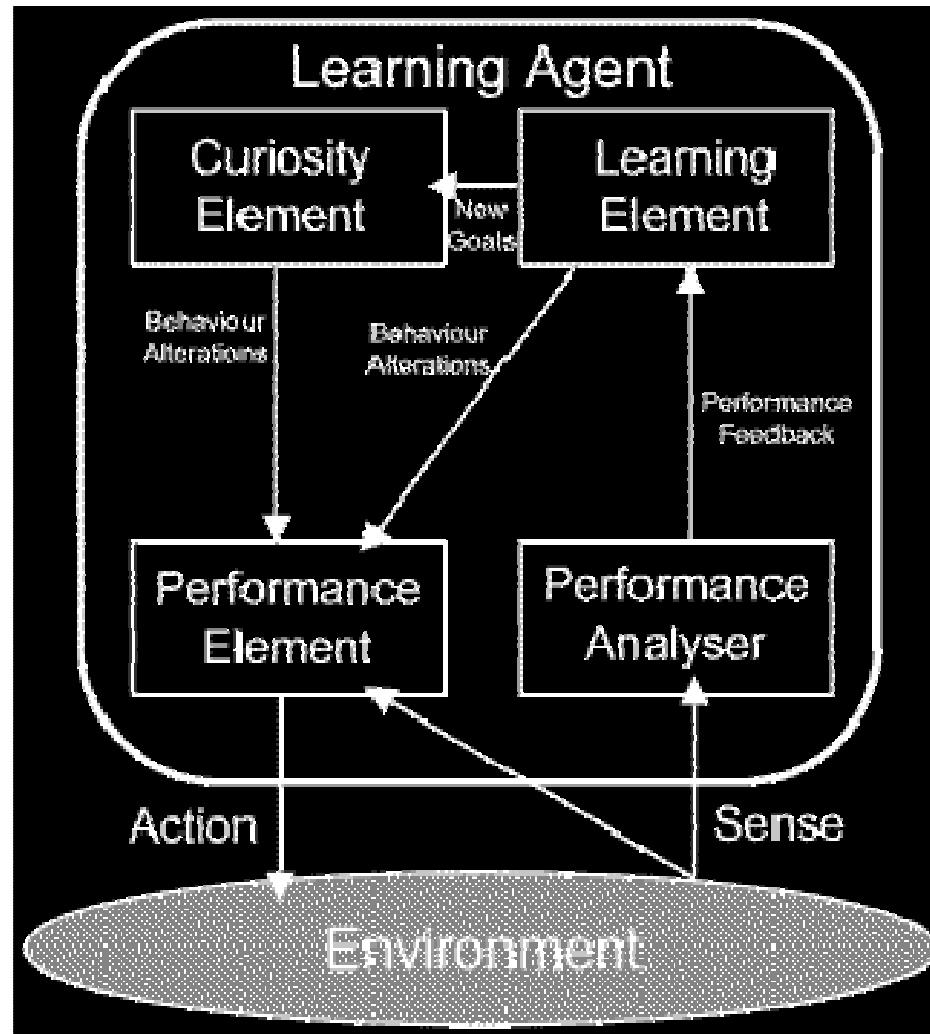the learning algorithm.

Create a Learning-Agent in the Game

fundamental parts :

- a learning element,

- a performance element,

- a curiosity element

- a performance analyser

a team-strategy based paintball game
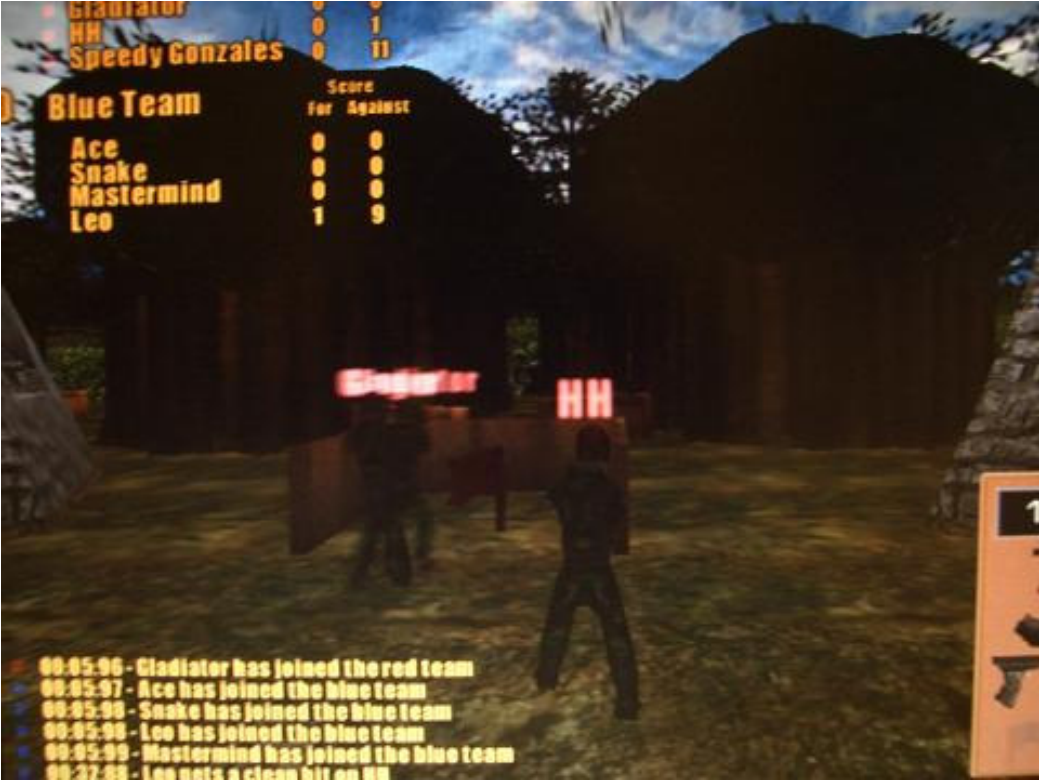
Some Problems

- Mimicking Stupidity

- Overfitting

- Local Optimality

- Set Behaviour

References

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