

Arthur Samuel

Arthur Lee Samuel (December 5, 1901 – July 29, 1990)^[3] was an American pioneer in the field of computer gaming and artificial intelligence.^[1] He popularized the term "machine learning" in 1959.^[4] The Samuel Checkers-playing Program was among the world's first successful self-learning programs, and as such a very early demonstration of the fundamental concept of artificial intelligence (AI).^[5] He was also a senior member in the TeX community who devoted much time giving personal attention to the needs of users and wrote an early TeX manual in 1983.^[6]

Contents

Biography

Computer checkers (draughts) development


Awards

Selected works

References

Biography

Samuel was born on December 5, 1901, in Emporia, Kansas, and graduated from College of Emporia in Kansas in 1923.^[3] He received a master's degree in Electrical Engineering from MIT in 1926, and taught for two years as instructor. In 1928, he joined Bell Laboratories, where he worked mostly on vacuum tubes, including improvements of radar during World War II.^[5] He developed a gas-discharge transmit-receive switch (TR tube) that allowed a single antenna to be used for both transmitting and receiving.^[7] After the war he moved to the University of Illinois at Urbana–Champaign, where he initiated the ILLIAC project, but left before its first computer was complete. Samuel went to IBM in Poughkeepsie, New York, in 1949, where he would conceive and carry out his most successful work. He is credited with one of the first software hash tables, and influencing early research in using transistors for computers at IBM.^[3] At IBM he made the first checkers program on IBM's first commercial computer, the IBM 701. The program was a sensational demonstration of the advances in both hardware and skilled programming and caused IBM's stock to increase 15 points overnight. His pioneering non-numerical programming helped shape the instruction set of processors, as he was one of the first to work with computers on projects other than computation.^[1] He was known for writing articles that made

Arthur Lee Samuel	
 <div></div>	
Born	December 5, 1901 <div></div> Emporia, Kansas <div></div>
Died	July 29, 1990 <div></div> (aged 88) <div></div> Stanford, California <div></div>
Citizenship	 United States
Alma mater	 MIT (Master 1926) <div></div> College of Emporia (1923)
Known for	Samuel Checkers-playing Program <div></div> Alpha–beta pruning (an early implementation) <div></div> Pioneer in Machine Learning^[1] <div></div> TeX project (with Donald Knuth) <div></div>
Awards	 Computer Pioneer Award (1987) ^[2]
Scientific career	
Fields	Computer Science
Institutions	 Bell Laboratories (1928) <div></div> University of Illinois (1946) <div></div> IBM Poughkeepsie Laboratory (1949)

complex subjects easy to understand. He was chosen to write an introduction to one of the earliest journals devoted to computing in 1953.^[8]

Stanford University
(1966)

In 1966, Samuel retired from IBM and became a professor at Stanford University, where he worked the remainder of his life. He worked with Donald Knuth on the TeX project, including writing some of the documentation. He continued to write software past his 88th birthday.^[6]

He was given the Computer Pioneer Award by the IEEE Computer Society in 1987.^[9] He died of complications from Parkinson's disease on July 29, 1990.^[5]

Computer checkers (draughts) development

Samuel is most known within the AI community for his groundbreaking work in computer checkers in 1959, and seminal research on machine learning, beginning in 1949.^[6] He graduated from MIT and taught at MIT and UIUC from 1946 to 1949.^[10] He believed teaching computers to play games was very fruitful for developing tactics appropriate to general problems, and he chose checkers as it is relatively simple though has a depth of strategy. The main driver of the machine was a search tree of the board positions reachable from the current state. Since he had only a very limited amount of available computer memory, Samuel implemented what is now called alpha-beta pruning.^[11] Instead of searching each path until it came to the game's conclusion, Samuel developed a scoring function based on the position of the board at any given time. This function tried to measure the chance of winning for each side at the given position. It took into account such things as the number of pieces on each side, the number of kings, and the proximity of pieces to being “kinged”. The program chose its move based on a minimax strategy, meaning it made the move that optimized the value of this function, assuming that the opponent was trying to optimize the value of the same function from its point of view.^[12]

Samuel also designed various mechanisms by which his program could become better. In what he called rote learning, the program remembered every position it had already seen, along with the terminal value of the reward function. This technique effectively extended the search depth at each of these positions. Samuel's later programs reevaluated the reward function based on input from professional games. He also had it play thousands of games against itself as another way of learning. With all of this work, Samuel's program reached a respectable amateur status, and was the first to play any board game at this high a level. He continued to work on checkers until the mid-1970s, at which point his program achieved sufficient skill to challenge a respectable amateur.^[13]

Awards

- 1987. Computer Pioneer Award.^[2]

For Adaptive non-numeric processing.

Selected works

- 1953. *Computing bit by bit, or Digital computers made easy*. Proceedings of the Institute of Radio Engineers 41, 1223-1230.^[8]
- Samuel, A. L. (2000). "Some studies in machine learning using the game of checkers". *IBM Journal of Research and Development*. **44**: 206–226. doi:10.1147/rd.441.0206 (<https://doi.org/10.1147%2Frd.441.0206>).

Pioneer of machine learning.

Reprinted with an additional annotated game in *Computers and Thought*, edited by Edward Feigenbaum and Julian Feldman (New York: McGraw-Hill, 1963), 71-105.

- 1983. *First Grade TeX: A Beginner's TeX Manual*. Stanford Computer Science Report STAN-CS-83-985 (<http://i.stanford.edu/TR/CS-TR-83-985.html>) (November 1983).

Senior member in TeX community.

References

1. John McCarthy; Edward Feigenbaum (1990). "In Memoriam Arthur Samuel: Pioneer in Machine Learning" (<http://www.aaai.org/ojs/index.php/aimagazine/article/view/840/758>). *AI Magazine*. AAAI. **11** (3). Retrieved 11 January 2015.
2. "1987 Computer Pioneer Award" (<http://www.computer.org/web/awards/pioneer-arthur-samuel>). *computer.org*. Computer Society. "For Adaptive non-numeric processing"
3. E. A. Weiss (1992). "Arthur Lee Samuel (1901-90)". *IEEE Annals of the History of Computing*. **14** (3): 55–69. doi:10.1109/85.150082 (<https://doi.org/10.1109%2F85.150082>).
4. Samuel, Arthur L. (1959). "Some Studies in Machine Learning Using the Game of Checkers". *IBM Journal of Research and Development*. **44**: 206–226. CiteSeerX 10.1.1.368.2254 (<https://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.368.2254>). doi:10.1147/rd.441.0206 (<https://doi.org/10.1147%2Frd.441.0206>).
5. Gio Wiederhold; John McCarthy; Ed Feigenbaum (1990). "Memorial Resolution: Arthur L. Samuel" (<https://web.archive.org/web/20110526195107/http://histsoc.stanford.edu/pdfmem/SamuelA.pdf>) (PDF). Stanford University Historical Society. Archived from the original (<http://histsoc.stanford.edu/pdfmem/SamuelA.pdf>) (PDF) on 26 May 2011. Retrieved April 29, 2011.
6. Donald Knuth (1990). "Arthur Lee Samuel, 1901-1990" (<http://www.tug.org/TUGboat/tb11-4/tb30knut-samuel.pdf>) (PDF). *TUGboat*. pp. 497–498. Retrieved April 29, 2011.
7. A. L. Samuel; J. W. Clark & W. W. Mumford (1946). "The Gas-Discharge Transmit-Receive Switch" (<https://archive.org/details/bellsystemtechni25amerrich>). *The Bell System Technical Journal*. **25**: 48–101. doi:10.1002/j.1538-7305.1946.tb00896.x (<https://doi.org/10.1002%2Fj.1538-7305.1946.tb00896.x>).
8. A. L. Samuel (1953). "Computing Bit by Bit or Digital Computers Made Easy". *Proceedings of the IRE*. **41** (10): 1223. doi:10.1109/JRPROC.1953.274271 (<https://doi.org/10.1109%2FJRPROC.1953.274271>). S2CID 51652282 (<https://api.semanticscholar.org/CorpusID:51652282>).
9. "Past recipients for Computer Pioneer Award" (<https://web.archive.org/web/20110322221848/http://awards.computer.org/ana/award/viewPastRecipients.action?id=13>). IEEE Computer Society. Archived from the original (<http://awards.computer.org/ana/award/viewPastRecipients.action?id=13>) on March 22, 2011. Retrieved April 29, 2011.
10. Narvaez, Alfonso a (1990-08-09). "Arthur Samuel, 88, Pioneer Researcher In Computer Science" (<https://www.nytimes.com/1990/08/09/obituaries/arthur-samuel-88-pioneer-researcher-in-computer-science.html>). *The New York Times*. ISSN 0362-4331 (<https://www.worldcat.org/issn/0362-4331>). Retrieved 2017-10-19.
11. Richard Sutton (May 30, 1990). "Samuel's Checkers Player" (<http://incompleteideas.net/book/11/node3.html>). *Reinforcement Learning: An Introduction*. MIT Press. Retrieved April 29, 2011.

12. Arthur, Samuel (1959-03-03). "Some Studies in Machine Learning Using the Game of Checkers". *IBM Journal of Research and Development*. **3** (3): 210–229. CiteSeerX [10.1.1.368.2254](https://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.368.2254) (<https://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.368.2254>). doi:[10.1147/rd.33.0210](https://doi.org/10.1147/rd.33.0210) (<https://doi.org/10.1147%2Frd.33.0210>).
 13. Schaeffer, Jonathan. *One Jump Ahead: Challenging Human Supremacy in Checkers*, 1997,2009, Springer, ISBN [978-0-387-76575-4](https://www.isbn-international.org/product/9780387765754). Chapter 6.
-

Retrieved from "https://en.wikipedia.org/w/index.php?title=Arthur_Samuel&oldid=1098493457"

This page was last edited on 16 July 2022, at 02:54 (UTC).

Text is available under the Creative Commons Attribution-ShareAlike License 3.0; additional terms may apply. By using this site, you agree to the Terms of Use and Privacy Policy. Wikipedia® is a registered trademark of the Wikimedia Foundation, Inc., a non-profit organization.