A Study of Basis on AI-based Information Systems: The Case of Shogi AI System "Ponanza"

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Background of Research Interest

What is the impact of AI to the research of marketing and business administration in social science?

- On the recommendation system of Amazon.com and the advertising system of Google, even business people who are in charge of these systems are **seeking out the basis on why it works**. (Yoda Y, Mizukoshi K. and Honjo S. , 2016)

- Marketing and Business Administration research has not been aligned with an AI system.

- Why?

Objectives

This study focuses on the relationship between AI and humans in terms of basis

– To deepen our understanding about the exploration of AI in corporate marketing

– To interpret how people and society respond in their attempt to comprehend the development and actions of AI.

Keywords

"A Study of Basis on AI-based Information Systems: The Case of Shogi AI System "Ponanza" "

Keywords:
- basis
- cause
- reason
- logical reasoning
- machine learning

Summary

In this study, we discuss the case of Ponanza, an AI based system for Japanese Chess "Shogi" and professional Shogi players because what happens between Shogi AI and **professional Shogi players can partially help humans and AI get clues in marketing**

- Shogi AI "Ponanza" became a **mystery even for its developers** in their process of building this system into one capable of defeating professional Shogi players

- It is now **open to interpretation** for its developers and professionals.

Summary: Conclusion

How do AI and humans create knowledge?

- – Specifically, when we treat AI **as an extension of humans**, it will be important to consider how AI and humans create knowledge and how humans can learn from AI.

- – In the future, interaction with AI can be expected to improve human's ability **to investigate "causes" and develop "reasons"**.

RESEARCH METHOD

Method: Case study

Scientific research method using qualitative data (Yin, 1994)

- Use of multiple sources

- Mutual confirmation of primary and secondary data

- Use of face-to-face interview

- Maintenance of a chain of evidence

Method: Case study

Why did we focus on Shogi AI at first?
What happens between Shogi AI and professional players **can partially help humans and AI get clues in marketing**

- Shogi is a game with fixed rules, played in a **static environment** and can therefore be studied as a case separated from the complicated and dynamic environment of society as business

- Professional Shogi players are considered one of the representative examples of the human intellect

- Superiority dispute between AI and humans is already settled. Shogi AI far surpassed Shogi players.

CASE STUDY "PONANZA"

Overview of Ponanza

Ponanza is a Shogi program that Issei Yamamoto developed

- As Shogi AI, it defeated a professional Shogi player for the first time on March 30, 2013.

- On May 20, 2017, it became the first Shogi AI to beat an active Shogi "Meijin" which is the most prestigious title of Shogi in Japan.

History

Table 1 Major matches between Shogi AI and Shogi players

Year	Details
2007	Exhibition match between Bonanza (AI) and Akira Watanabe, Ryuou (Winner)
	Bonanza (AI) made open source *partially used as reference for Ponanza too
2012	Bonkras (AI Winner) vs. Kunio Yonenaga, Eisei Kisei
2013	Ponanza (AI Winner) vs. Shinichi Satoh, 4-dan(*Shogi AI's first victory over an active professional Shogi player
2014	Ponanza (AI Winner) vs. Nobuyuki Yashiki, 9-dan
2015	Ponanza (AI Winner) vs. Yasuaki Murayama, 9-dan Winner of the 25th World Computer Shogi Championship
2016	Ponanza (AI Winner) vs. Takayuki Yamasaki, 8-dan
2017	Ponanza (Ai Winner) vs. Amahiko Satoh, Meijin (Highest title) **Shogi AI's first victory over an active Meijin**

(1) Overview of Ponanza

Shogi AI requires 2 functions as in the case of human intellectual activities

- **Exploration**, refers **to the ability to predict and correctly emulate the future** (make a guess without adding one's subjective views or judgement) called reading.

- However, because it is difficult to completely explore all of the large number of situations due to **resource constraints**, **computers determine the next move by prioritizing choices**. This process of marking highlights is referred to as **evaluation**.

(1) Overview of Ponanza

Shogi AI requires 2 functions as in the case of human intellectual activities

– **Exploration** The area of exploration is gradually reduced, as needed, to effectively use the limited resources.

– **Evaluation** Humans program the "exploration" part, which was a main function, and specified how the exploration was to be conducted, while the computer learns to "evaluate" by itself through the introduction of **machine learning**

(1) Overview of Ponanza

The 1st Version of Ponanza

– Ponanza needed a function to express the adjustments between the more than **one hundred million parameters** as "**evaluation parameters**" in order to represent the complexity of Shogi, based on **three-piece relationships**, including the King.

– **Ponanza could play moves similar to 45% of the Shogi players through 50,000 games as training data.**

(1) Overview of Ponanza

On March 30, 2013 for the first time, AI defeated an active Shogi player

– Machine learning based parameter adjustments by computers are faster and more accurate than manual parameter adjustments by humans.

– Therefore, Yamamoto decided to thoroughly train (adjust parameters) the computer for the parameter function and devoted himself to describing through a program how the computer should be trained to evaluate.

(1) Overview of Ponanza

Shogi AI's first victory over an active Meijin in 2017

– In 2014, Yamamoto introduced **reinforcement learning**, which is **unsupervised learning**, after working on supervised learning where Ponanza learned from game records of Shogi players.

– He accumulated about **eight billion such situations** and has eventually analyzed nearly **one trillion situations**. This process results in determining new **Ponanza-style tactics**, which refers to sequences that do **not exist** in games played between humans.

(2) Developer's Perspective

Black magic?

– As Ponanza's performance improves, it is becoming more and more difficult to be explained. Yamamoto compared its mystery to **"Black magic"**

– Yamamoto says that he "had no clue" about the workings of the improvements that proved effective. In concrete terms, he says that **he does not understand the real reason why the values fed in the program work or why a certain combination of values is effective.**

(2) Developer's Perspective

Black magic?

– For example, Idle parallelization: Multiple cores of the CPU separately carry out the same processing and the effective methods that each core accidently discovers are shared with the entire system.

– Interestingly, even experts find it difficult to explain why randomly shared methods work well.

– Best possible explanation is that "**an experiment turned out well**."

(3) Shogi Player's Perspective

Shogi AI Intelligence?

– For example, Shogi AI made an exceptional move to build defense by giving up a piece to the Meijin who had no attacking pieces. This was against Shogi theory,

– The opponent, Satoh Meijin, **he was unable to understand the meaning of the move** because he held **preconceived notions** such as sacrificing a pawn when the opponent has two pieces that are effective. He said that he was unable to anticipate the move.

(3) Shogi Player's Perspective

Shogi players could express the reasons by their contextual expressions by language after deep consideration

– Such as **sacrificing a pawn when the opponent has two pieces that are effective**. (Satoh Meijin, NHK, July 31, 2017).

– Moreover, Yoshiharu Habu explained "**humans found it difficult to imagine a situation where a player would use a piece that is neither attacking nor defending, and even give up a pawn to the opponent who does not have one**". (Habu, NHK 2017).

(3) Shogi Player's Perspective

"Shogi players have been learning from AI through dialogue"

- Satoh Meijin says that this showed that there could be best moves in Shogi that **humans do not see any reason** for (that humans find difficult to understand). (Satoh Meijin, NHK 2017).

- Shogi players are beginning to **find ways to learn from Shogi AI**

- For example. Shogi players are placing importance on learning positioning judgment from Shogi AI.

DISCUSSION

Discussion

3 Stages of Collaboration by Humans and AI

Stage	Strength / Knowledge	How to Actualize
1st "Imitation"	Humans	Supervised Learning by Humans Data
2nd "Implemen- tation"	AI	Humans Attempted to Adjust Parameters with Trial and Error
3rd "Black Magic"	Internalized in AI	Humans use Language to Understand and Explain Why

We could create knowledge through interaction

Discussion

Humans are capable of taking two kinds of "Basis" approaches. **Cause** and **Reason** in philosophy

How to treat AI	Characteristics	Basis (Why, Foundation)
AI as a Physical Phenomenon	A certain result is produced under certain conditions, even though we do not understand the logic behind it.	An investigation of the **"cause"** of a phenomena without depending on language.
As an Extension to Humans	Humans and society, not AI, ask the foundation as to "why" AI is able to produce certain results. That is why, **contextual and language-based "reasons"** should be expected by humans and society.	Building a model and seek a **"reason"** as a basis for understanding.

Discussion

What is the challenge for humans?

– To produce a logic to justify the basis just like **logical reasoning** rather than discovering a working principle or "cause."

How do AI and humans create knowledge?

– During externalization in the SECI model (Nonaka and Takeuchi, 1995**),** **tacit knowledge** is converted into **explicit knowledge** through dialogue between individuals. The concept of **dialogue between two humans may be extended to imagine an interaction between AI and humans** where the latter learns from the former.

Conclusion

Key Implications

– When we treat **AI as an extension of humans (not a physical phenomenon)**, it will be important to consider how AI and humans create knowledge and how humans can learn from AI.

– Interaction with AI can be expected to improve human's ability **to investigate "causes" and develop "reasons" by logical reasoning**.

– **Dialogue between AI and humans can create new knowledge.**

Acknowledgments

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