Interpretable AI as Curation

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Abstract

"Interpretable AI" is an artificial intelligence (AI) whose actions can be easily understood by humans. This is a theme of the workshop. For this theme, I will show several possibilities. For the "Interpretable AI," the key factor is curation. One of the main function of curation is to show something (person's concept etc.) to other persons. In addition curation should be conducted according to users' cognitive level. From this viewpoint in this paper I discuss two types curations and the effectiveness of curation. In addition, from the cognitive bias, I will also discuss two types curations.

Introduction

"Interpretable AI" is an artificial intelligence (AI) whose actions can be easily understood by humans. This is a theme of the workshop. For this theme, I will show several possibilities.

For the "Interpretable AI," the key factor is curation. Details of curation are shown in the next section. But briefly illustrated, one of the main function of curation is to show something (person's concept etc.) to other persons. In addition curation should be conducted according to users' cognitive level. For this, as interpretable AI strategies, I will show a dementia person care system inspired by affordance and a new curation system. Where "Interpretable AI" can be achieved. In addition from the cognitive bias, I will also discuss the the dementia person care system inspired by affordance and the new curation system.

In the following, I will show two types of interpretable AI strategy based curation.

Curatioin

Recently, in several situations, the word "curation" has been used. For instance, in the marketing strategies, for fashion shows, and for a DJ etc. This section reviews various types of curation. Actually curatorial task is usually used for tasks in (art) museum. In the previous papers I several times reviewed curation, so I introduce very typical curation which makes the visitors think themselves.

(General) curation

There is at least a person who is responsible as "curator" in (special) exhibitions, galleries, archive, or (art) museums. Their main task of curator is a curatorial task, which is multifaceted. Curator comes from a Latin word "cura" which means cure. Then originally it used for a person who take care of a cultural heritage.

In the report by American Association of Museums Curators Committee (AAMCC) [AAMCC, 2009], they pointed out "curators are highly knowledgeable, experienced, or educated in a discipline relevant to the museum's purpose or mission. Curatorial roles and responsibilities vary widely within the museum community and within the museum itself, and may also be fulfilled by staff members with other titles." Then they showed the definition of curator as follows;

- Remain current in the scholarly developments within their field(s); conduct original research and develop new scholarship that contributes to the advancement of the body of knowledge within their field(s) and within the museum profession as a whole.
- Make recommendations for acquiring and deaccessioning objects in the museum collection.
- Assume responsibility for the overall care and development of the collection, which may include artifacts, fine art, specimens, historic structures, and intellectual property.
- Advocate for and participate in the formulation of institutional policies and procedures for the care of the collection that are based on accepted professional standards and best practices as defined by AAM, CurCom, and other relevant professional organizations.
- Perform research to identify materials in the collection and to document their history.
- Interpret the objects belonging or loaned to the museum.
- Develop and organize exhibitions.
- Contribute to programs and educational materials.
- Advocate and provide for public use of the collection.
- Develop or contribute to monographs, essays, research papers, and other products of original thought.
- Represent their institution in the media, at public gatherings, and at professional conferences and seminars.
- Remain current on all state, national, and international laws as they pertain to objects in the museum collection.

In addition, AAMCC showed curatorial responsibilities as follows;

A. Research, Scholarship, and Integrity
B. Interpretation
C. Acquisition, Care, and Disposal
D. Collection Access and Use
E. Replication of Objects in the Collection

Thus curators have responsibilities for various aspects of exhibition activities. However, the most important activity will be a plan of exhibition. For that the above activities such as research, interpretation and acquisition are necessary. They should properly exhibit a truth which is result of their researches and interpretations.

In addition, their researches and interpretations properly communicate to the visitors. In the next section, however, I introduce the curation example with implicit communication of curator's researches and interpretations.

Exhibition "Bacon and Caravaggio"

An exhibition "Bacon and Caravaggio" was held in Museo e Galleria Borghese, Roma, Italy during October 2 2009 and January 24 2010.

The display policy of this exhibition is rather different from the general special exhibition. First, the special exhibition was not separated from the space for permanent collections. Of course several Caravaggio's works were exhibited in their original places. The other Caravaggio's works and Bacon's works were exhibited between the permanent collections. For this type exhibition, usually exhibition is educational and two painters are compared in various point, for instance days and society painters lived. Before arriving at the exhibition, my expectation was that it would be an exhibition to address the contrast between the drawing policies of Bacon and Caravaggio. Caravaggio usually painted a perfect body of human beings. On the other hand, Bacon usually painted a flesh of human beings most of parts are removed to express the essence of human existence. However, in the catalogue of the exhibition "Bacon and Caravaggio," at first, Coliva wrote "This exhibition proposes a juxtaposition of Bacon and Caravaggio. It intends to offer visitors an opportunity for an aesthetic experience rather than an educational one... [Colvia, 2009]." Then Coliva continued

"An exhibition of generally conceived and prepared with a historicist mentality, but when it materializes, the simultaneous presence of the works — in the sense precisely of their hanging — opens up parallels and poses very complex and spontaneous questions, which may even be unexpected and not all stem exactly from questions initially posed by art-historical motives and theses. There are parallels that appear by themselves to the visitor's sensibility and are not imposed by a theory of the curator. This is certainly one aspect of the vitality of exhibitions, which make the works live and in this are necessary for the works. The display itself, in the sense of the presentation of the works that appear in an exhibition —the spectacle of their being on display — creates trains of thought that are independent of the interpretations provided by art-historical scholarship. And since for a profound experience of understanding a work these ramifications sometimes are

more surprising and significant than the achievements of a specialized scholarship in its own field of action, an art raised to the status of an enigma like Bacon's seems to require the gamble of provoking these parallels. And since at the time, and again because of its qualitative greatness, Caravaggio's art deserves a similar provocation, the juxtaposition thus satisfies a legitimate aesthetic desire. On the other hand, the juxtaposition is a modest and prudent solution, not so much for demonstrating, but for offering the attribute of "genius" — which the expressive common language attributes to the great artist of the past — opportunities to manifest itself. And the juxtaposition is induced by the Galleria Borghese itself, one of the most sensitive spaces with the simultaneous presence of genius."

Besides the importance in aesthetics and philosophy, I think the most important point is that "There are parallels that appear by themselves to the visitor's sensibility and are not imposed by a theory of the curator." That is, though actually a curator has a certain philosophy, he/she does not insist his/her philosophy but audiences will be able to discover additional meanings as well as the curator's intended philosophy.

This type of curation used to be rare, but recently the importance of this type of curation has been recognised.

From the viewpoint of "Interpretable AI," this type of curation is meaningful. In fact the curation does not seem to make effort to make visitors understand what should inform. Furthermore this type of curation reduces detailed explanations. However the merit of this type of curation is make visitors think themselves. That is visitors try to interpret/understand as many as possible, and they can understand more than what are shown in the captions.

Curation as Chance Discovery

In [Abe, 2010], I proposed and defined a concept of curation in chance discovery[1].

Though in various articles, the definition of a "chance" is described which was introduced by Ohsawa [Ohsawa and McBurney, 2003], I wish to introduce it here again. In fact, it rather differs from the original definition in [Ohsawa and McBurney, 2003] to reflect the recent research interests.

A chance is rare, hidden, potential or novel event(s) / situation(s) that can be conceived either as a future opportunity or risk.

Then "chance discovery" research is a type of research to establish methods, strategies, theories, and even activities to discover a chance. In addition, it aims at discovering human factors for chance discoveries.

Accordingly a definition of curation in chance discovery is:

- Curation is a task to offer users opportunities to discover chances.

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[1]In [Abe, 2011] and [Abe, 2012a], I extended the definition of curation in chance discovery, which introduced a concept of holistic communication [Akiyama and Sugiyama, 2004]. In this paper, I used the extended version of curation.

- Curation should be conducted with considering to offer implicit and potential possibilities.

- Chances should not be explicitly displayed to users.

- However, such chances should rather easily be discovered and arranged according to the user's interests and situations. This can be achieved for instance by affordance.

- There can be a certain holistic communication environment. This type of holistic communication might function as media to discover chance for novice users.

- There should be a certain freedom for user to interpret a key person, matter, thing or event, which should only stimulate or assist users' thinking procedure.

- There should be a certain freedom for user to arrange chances.

The main point of curation is how to display data to users and how not to insist on any interpretation to users. But critical point to understand the data should be presented. Accordingly, users can rather easily deal with data and can interpret data flexibly, freely and properly. And as I pointed out before, the merit of this type of curation is make visitors think themselves. That is visitors try to interpret/understand as many as possible, and they can understand more than what are shown in the captions. Thus "interpretable" can be kept.

Dementia person support based on the concept odf curation.

This section discusses "Interpretable AI" from the aspect of how to make understand an object especially to dementia persons.

Thanks to the advanced and innovative medical treatment, we are able to live longer. It will be happy to live long, but the other problems are caused by such long lives. One of the most serious problems is increasing patients who are suffered from cancer. It will be able to be overcome by the advancement of medical treatment and is a problem for individuals. Furthermore the more serious problem for a person and even for his/her family and surroundings will be dementia. It is the progressive decline in cognitive function due to damage or disease in the body beyond what might be expected from normal aging. Dementia persons cannot reasonably live their lives. It is said that the current medical treatment cannot cure dementia completely. Even in the near future, it will be negative to cure dementia. Dementia is caused by problems in a brain. Accordingly, it is more difficult to cure dementia than cancer. Currently, some methods to delay the progress of dementia are proposed. For instance, a therapy room or house will be one of the solution to take care of dementia person [Sloane et al., 2002]. Actually, it is rather a support system for dementia person's everyday life.

Affordance

Gibson ecologically introduced the concept of affordance for perceptional phenomena [Gibson, 1977, Gibson, 1979]. It emphasizes the environmental information available in extended spatial and temporal pattern in optic arrays, for guiding the behaviors of animals, and for specifying ecological events. Thus he defined the affordance of something as "a specific combination of the properties of its substance and its surfaces taken with reference to an animal." For instance, the affordance of climbing a stair step in a bipedal fashion has been described in terms of the height of a stair riser taken with reference to a person's leg length [Warren, 1984]. That is, if a stair riser is less than 88% of a person's leg length, then that means that the person can climb that stair. On the other hand, if a stair riser is greater than 88% of the person's leg length, then that means that the person cannot climb that stair, at least not in a bipedal fashion. For that Jones pointed out that "it should be noted also that this is true regardless of whether the person is aware of the relation between his or her leg length and the stair riser's height, which suggests further that the meaning is not internally constructed and stored but rather is inherent in the person's environment system" [Jones, 2003].

Dementia care inspired by affordance

In [Abe, 2012b], I proposed the framework of a dementia person support system. Bozeat and Hodges analyzed the feature of mapping between objects and their meaning for semantic dementia person from four factors — affordance, presence of recipient, familiarity, and problem solving [Bozeat et al., 2012, Hodges et al., 2000]. They showed very interesting results For instance, they pointed out "as a group, the patients did not achieve better performance on a subset of affordable objects when use of these was compared with a familiarity-matched subset of objects lacking such affordances. This absence of a general group benefit applied both to overall use and to the specific component of use afforded by the object's structure.[...]it became clear that there was a reliable benefit of affordance on the specific components of use, but only for the most impaired patients." They also pointed out "The impact of recipient, like affordance, was found to be modulated by the degree of semantic impairment. The patients with a moderate level of conceptual impairment demonstrated significantly better use with the recipient present, whereas the patients with mild and severe impairment showed no effect. [...] It was not surprising, therefore, to find that familiarity also influenced performance on object use assessments." These observations and analyses show that proper affordance might give a certain support to dementia persons understanding (meanings of) objects.

For normal persons, it is not so difficult to provide such a guidance. They can also understand analogy, so that they can extend the meaning to the other materials. For instance, after finding that a tree stump functions as a chair, they can also understand a wooden board or box can also function as a chair. That is, they can extend or map the meaning to the other situations. However, for dementia persons, it is not easy to provide a proper guidance with which they can afford the function of an object. Actually, for person who does not have common knowledge or context, it is also not easy to provide a proper guidance for affordance discovery. For them affordance is something rare or novel. Accordingly, it is rather difficult to be aware of "affordance" as an afforded matter. In therapy houses, there should be many

things which are not able to properly used by dementia persons. In the case, it is necessary to provide certain guidance's to lead the user to the correct direction to use things properly. The simplest method will be to attach the name and usage of things. It will functions well for normal persons. However, for impaired persons, sometimes even such attachment will not function well. For them, it will be necessary to apply the other strategy to suggest or instruct the meaning or usage of things. For semantic dementia persons, it is observed that they did not achieve better performance on a subset of affordable objects when use of these was compared with a familiarity-matched subset of objects lacking such affordances. Therefore, when we design an environment for dementia persons, it is necessary to consider such unhappy situations. It is necessary to prepare specialized affordances to dementia person. Even if they can detect affordance, they might not understand what it will emerge.

For affordance, according to the Gibson's definition, an $Object$ is observed and affordance is detected in the environment to understand its meaning. Then, when meaning is fixed, by using abduction framework, the affordance determination situation will be logically described as follows:

$$F \cup Object \cup affordance \models meaning \quad (1)$$
$$F \cup Object \cup affordance \not\models \Box \quad (2)$$

The above is described based on the formalization of Theorist [Poole et al., 1987]. Affordance can be regarded as a set of hypothesis. We can select consistent affordance (equation (2)) in the environment (hypothesis base) to explain meaning. In addition, for understanding subset of or similar afforded objects ($Object'$), the affordance determination situation will be logically described as follows:

$$F \cup Object \cup Object' \cup M \cup affordance \models meaning \quad (3)$$

In fact, the above description is based on Goebel's formalization of analogy [Goebel, 1989]. M is a mapping function from $Object$ to $Object'$. That is, to understand the same meaning of the subset of or similar afforded objects, an additional mapping function M is required. Thus if M can be determined and the usage of $Object$ is known, $Object'$ can also be understood. In fact, for normal persons, M is easy to understand. However, for dementia persons, it is pointed out that it is rather difficult to understand and determine M. Then the issue becomes how to suggest a mapping function M as an additional hypothesis. One of the solution is to introduce a shikake. According to Matsumura's definition [Matumura, 2013], a shikake is an embodied trigger for behaviour change to solve social or personal issues. As a result of the action, all or part of problem will be solved. It may not sometimes be the person's will. Matsumura continues that the shikake should be properly designed. That is, the relationship between a problem to solve and a trigger to action should be properly designed. I proposed the system with a shikake [Abe, 2017].

$$F \cup Object \cup Object' \cup shikake \cup M \cup affordance \models meaning \quad (4)$$

$$F \cup Object \cup affordance \not\models \Box \quad (5)$$

A shikake can function as a the other object with mapping function. $Object' \cup shikake$ means that $Object'$ is a shikake to select a proper affordance for guessing the meaning or function of $Object$. For instance, if somebody does not understand the meaning or usage of a folding bed, a folding wallet can be placed near the folding bed or shown to the user. Perhaps it will be better to show the wallet in an unfolding style. Thus by the help of a shikake, poeple can select a proper affordance to understand the meaning of the object.

Figure 1: Shikake in the proposal system.

In some case, $Object'$ is a shikake. From the viewpoint of "Interpretable AI," as I mentioned above, this type of curation tries to make (dementia) persons think themselves. That is if all information is shown (dementia) persons think no more, then dementia may proceed. However by the mapping via a shikake the message will be interpretable.

This study was assumed for dimentia persons. However it can be applied to normal person as well.

Curation for museum visitors.

This section discusses "Interpretable AI" from the captions in museum.

Captions in museums

In museums, especially in art museum, there are several visitors only reading captions (short explanation displayed next to artwork in exhibition room) without seeing any artworks. Tadaki and Abe tried to add psychological triggers by adding some features to captions. The presence of change in how they see artwork was measured by time spent to see artworks, movement from caption to artwork, and participants' impressions to each artworks and each captions [Tadaki and Abe, 2017]. We regarded a caption as a Shikake which is aiming to make visitors see artwork, each caption already has a physical trigger. By our experiment, we can suggest the possibility of a Shikake displayed in text as well as objects. In addition, in [Tadaki and Abe, 2018], we questioned "would people use different strategies to evaluate the painting for each abstract painting and representational painting?." Our experiment was to control the description of captions. For instance, we hided the title of the abstract painting

(Figure 3) (Forêt by Jean Fautrier (Figure 2)). The painting would be rather difficult to understand or create story without the title. However, if the title (Forêt (forest)) was given to the audience (they could open the hidden title), one of them created a story "I found a fairy in a forest." Thus a certain hint or guidance can support person to understand a difficult matters. This type of a shikake will be able to support person's understanding.
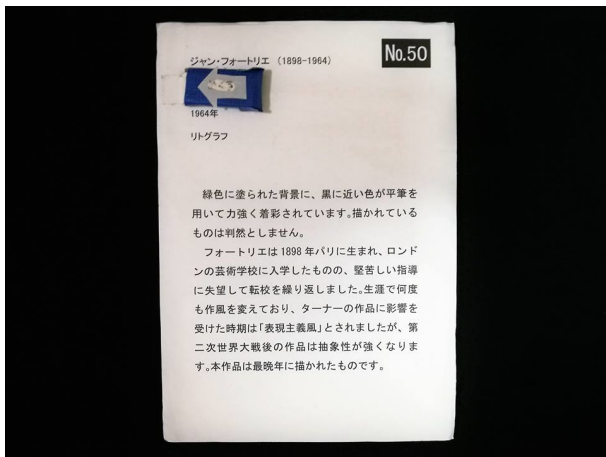

Figure 2: Forêt by Jean Fautrier

Figure 3: Caption with hidden title

Captions with several levels of explanation

In the previous experiment, a title is hidden. Especially for an abstract painting if title is missing, it is very difficult guess what is drawn. When a title is given, new image appears in participant's brain. In this experiment, our question is the effect of caption according to its contents. We used the painting shown Figure 4. We prepared three levels of question as follows;

- Please imagine and write the story occurring in the painting.

- The title of this painting is "New Day," please imagine and write the story occurring in the painting. If something are different from what you imagined in the previous question, please write them.

- The painter who drew this painting is a female painter living in Beograd in Selvia. Her name is Ivana Živić. She was born in 1979 in Sarajevo. She drew this painting in 2018. Please imagine and write the story occurring in the painting. If something are different from what you imagined in the previous question, please write them.

Figure 4: Experiment

One of the answer sets is:

- Since she is ill or is confined in the house, she cannot go out of her house. She dreams to go out to the outside world and go out from the window in her mind.

- The reason she could not go out of her house was not unavoidable but intentional. And she did not dream to go out of her house but did go out of her house.

- She remembers her girlhood. She remember that since outside world was danger she wanted to go out of house but could not, and that she strongly dreamed that she could go out of house. Before shown the statement I think the painter drew current situation but after reading it I changed my mind to think that she drew in her reminiscence. The reason why she did not go out of house was the Yugoslav Wars?

The other answer sets were almost similar. The participants seem to be able to gradually understand the art work. Even such a representational painting, the level of understanding is gradually changing. For abstract paintings this type of caption functions more like the Jean Fautrier's case.

This type of showing system according to the cognitive level is very important. In the dementia person assistant system shown in the previous section, shikake should also be prepared according to the cognitive level. The gradually showing strategy can be regarded as shikake. In addition, this shikake may automatically selected according to users interest and knowledge.

Toward cognitive bias.

A cognitive bias is a systematic error in thinking that affects the decisions and judgments that people make. Some of these biases are related to **memory**. The way you remember an event may be biased for a number of reasons and that in turn can lead to biased thinking and decision-making. Other cognitive biases might be related to problems with **attention**. Since attention is a limited resource, people have to be selective about what they pay attention to in the world around them. Because of this, subtle biases can creep in and influence the way you see and think about the world. [Cherry, 2018] And Cherry pointed out that a cognitive bias occurs when people are processing and interpreting information in the world around them. Also Cherry pointed out that Cognitive bias is not necessarily all bad, however. Psychologists believe that many of these biases serve an adaptive purpose —they allow us to reach decisions quickly. This can be vital if we are facing a dangerous or threatening situation.

A few of the most common types of cognitive biases that can distort our thinking are;

- Confirmation Bias: This is favoring information that conforms to your existing beliefs and discounting evidence that does not conform.

- Availability Heuristic: This is placing greater value on information that comes to your mind quickly. You give greater credence to this information and tend to overestimate the probability and likelihood of similar things happening in the future.

- Attentional Bias: This is the tendency to pay attention to some things while simultaneously ignoring others. When making a decision on which car to buy, you may pay attention to the look and feel of the exterior and interior, but ignore the safety record and gas mileage.

Thus a cognitive bias is rooted in thought processing errors often arising from problems with memory, attention, attribution, and other mental mistakes. A cognitive bias is not logical. The problem is it is not logical.

If the thinking system is logical, it can be logically solved. However, it is not logical. In addition, it is not always be solved. As pointed out in behavioral economics, sometimes it is not logical but reasonable. If it should be solved, the proposed methods can function well. Because they can control our attention and help our memory.

Conclusions

I showed two types of strategies for "Interpretable AI." Which were a dementia person care system inspired by affordance and a new curation system. In fact, for the dementia person care system inspired by affordance, I used a term "shikake," it can be regarded as various types of stimuli. Thus it will be possible to install several types of stimuli in the environment for the better understanding. And this helps users interpretation. Especially for dementia persons by a help of selecting affordance, an interpretation of something is powered. For the new type of curation, strategies were experimented and showed good results for "Interpretable AI."

I also discussed cognitive bias by the proposed systems.

In the future, more experiments can be conducted to show the better results and propose the better system.

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