Workshop: Using Network Analysis to Understand Cultural Representations of Machine Vision

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Workshop leaders

Jill Walker Rettberg, Ragnhild Solberg, and Linn Heidi Stokkedal (Digital Culture, University of Bergen.

Materials needed

Please bring your own computer. If you wish to use Gephi you will need to preinstall the software, which is open source and cross-platform, and can be downloaded from http://gephi.org.

Relevance

- TWG6 Visual Communication and Culture (machine vision technologies)
- TWG3 Game studies (games are being analysed)
- Division 10 Film and Television studies (film and television being analysed)
- TWG2 Gender and the Media (research question about gender/racial bias)

Workshop Description

In this workshop we invite participants to participate in data exploration to discover patterns that could lead to new understandings of the cultural impact of machine vision. We will present the Machine Vision database, which we are developing to map cultural representations of the use and representation of machine vision technologies in games, artworks, narratives and popular culture. We will discuss some of the questions we have been grappling with when developing our interpretative coding schema, then will allow participants to explore the database, identify interesting patterns in the data and discuss the methodology. We will also demonstrate how we are using network analysis in Gephi to analyse the data, and participants who have installed Gephi on their computers will be able to try this for themselves.

After the presentation of the project and an initial exploration of the database, participants will be divided into groups depending on their interests, choosing one of the following tasks:

1. Use a web browser to explore the database, discussing patterns they may find, developing hypotheses that might be tested with data analysis, or discussing methodological issues of this approach to media research.
2. Use Gephi to explore network visualisations of provided datasets exported from the database. Basic knowledge of Gephi is useful but not necessary.

This 1,5 hour workshop cannot give a full introduction to network analysis, but provides a useful example of how participating researchers might consider using network analysis in their own projects. It also opens up a research project as it is in progress. We expect the input from workshop participants to be valuable in the further development of the data analysis, which is planned to be completed by the end of 2019. Additionally, the project will make the data openly available, meaning that participants can use the material in their own teaching or research.

What is Machine Vision?

We define machine vision as the registration, analysis and representation of visual data by machines and algorithms. These technologies are becoming more and more deeply embedded in our everyday lives. We use Snapchat lenses to add dog ears to our selfies to to see what we would look like as another gender. Algorithms analyse and sort our personal photographs and Instagram feeds, using object recognition, facial recognition, aesthetic inference algorithms and more (Rettberg 2019). Neural networks are being trained to generate more and more realistic images and videos, leading to concerns about deepfakes. Smart home surveillance systems can alert us when a stranger enters the neighbourhood (Kurwa 2019) or the nanny looks sad (Pierce 2019).

The Machine Vision Project

The workshop is hosted by the ERC project *Machine Vision in Everyday Life: Playful Interactions with Visual Technologies in Digital Art, Games, Narratives and Social Media*, led by Jill Walker Rettberg at the University of Bergen. The overall objective of the *Machine Vision* project is to develop a novel theory that explains how the algorithmic machine vision of the 21st century affects the way ordinary people see themselves and understand the world. This is broken this down into three research questions:

1. Which kinds of agency develop, and which are limited in the interaction between individual users and machine vision?

2. How does machine vision lead us to experience the visual as data that can be manipulated, and does this lead us to see the world and ourselves as malleable?

3. Which values are embedded in machine vision, and which biases are introduced or supported?

The larger project will do this through historical and theoretical research, through ethnographic fieldwork with developers and users, through close analysis of salient examples of artworks, games and narratives, and through the digital humanities project presented in this workshop. Our goal in this part of the project is to identify patterns in how machine vision is portrayed in art, games and narratives (Rettberg et al. 2019). For instance, we may find that certain kinds of agency are more common in games than in digital art, or in dystopic representations of machine vision in contrast to more positive representations. Or, we may find that certain technologies, e.g. facial recognition, optical implants or augmented reality, are understood as neutral tools, while other machine vision technologies tend to be portrayed as hostile or alien. Identifying such

patterns will then guide our qualitative research design for the later stages of the project.

The project team is developing a database with a set of metadata describing several hundred games, artworks and narratives (e.g. movies or novels) that thematise or simulate machine vision technologies. Each work has its own entry in the database, and situations involving machine vision are identified for each work. The team has developed metadata aimed at allowing us to explore our research questions about agency, objectivity and bias. We began this work in January 2019 and plan to complete the data collection and analysis by the end of 2019.

Methodological Questions

We are grappling with a number of methodological questions as we develop the database and the coding schema, and would appreciate discussion of these at the workshop, to the extent that time allows.

Interpretations as data?

Are there good examples of collaborative, hermeneutic, interpretations of art, games, movies, novels or similar genres that develop shared coding structures as we are doing, and that we should be consulting? Developing a coding schema and coding as a team is more common for more social science-oriented methodologies, such as content analysis or coding ethnographic interviews. Is it possible to combine humanistic, hermeneutic interpretation with the more quantitative demands of a shared coding schema, which is necessary to be able to do any kind of *interpretative* distant reading?

Most examples of distant reading (Moretti 2005; Jockers 2013), digital methods (Rogers 2013) or cultural analytics (Manovich 2018) use data that either already exists as data (e.g. showing how the novel first developed by charting the number of novels published each year in different countries, or creating a network analysis of tweets using hashtags, retweets, and @mentions), or that is uncontroversial and generally not up for interpretation or debate, such as whether two characters are present in the same scene in a movie or not.

In contrast, most of the data in our database is interpretative. For instance, we state that *Iron Man* (2008) has the following themes: automation, conflict, economy, hacking, inequality, physical violence, robots/androids and war. In our analysis of the workshop scenes at Tony Stark's house, where Stark designs the Iron Man suit using manipulable holographic displays, it seems fairly unproblematic to state that the operator of the machine vision (Stark) is human, white, privileged and male. But when we say that he feels the machine vision technology is empowering, exciting and protective, we are certainly interpreting.

Is it possible to agree upon this sort of interpretative coding schema as a group? How valid will our results be when somebody else objects to our interpretation? We could use a strict content analysis methodology and have two separate people code everything separately and measure intercoder reliability – but that seems to assume

that there *is* a correct answer, and to disregard the interpretative independence and generativity of humanities scholarship. We have chosen to discuss many works in our full team as we have developed the coding schema, and once we have agreement on what the codes mean, to work individually, asking for help from another team member when in doubt.

How to code for intersectionality

The representation of race and gender is important to our research question about bias, and potentially also to agency. How do we code for race and gender without reducing them to stereotypes? Particularly in science fiction, race and gender are often represented in complex, experimental ways. Obviously a simply male/female binary is insufficient.

Avoiding automatic binaries

Can we avoid binaries when using a database? Gender is discussed above, but there are other binaries, such as the subject/object divide familiar from cinema studies. We have replicated this to some extent by describing the operator of machine vision and the persons viewed by machine vision. Talking about an operator means thinking about a subject, who acts upon or views others, who are objects. Using these terms may lock us into binaries that were developed for old visual technologies – and after all, we are trying to explore *new and different ways of seeing* that may be emerging with new visual technologies. A starting point for the project as a whole is the posthumanist view that agency is distributed, and that the subject/object binary is too simplistic.

The operator/viewed binary does work for some representations of machine vision, such as facial recognition used in surveillance systems, or a smart weapon targeting an individual. It doesn't work at all with some kinds of image generation, such as the deepfake-like, weaponised visual illusions used in *Spiderman: Far from Home* (2019). It may work with deepfake videos on social media, although it seems a stretch (is the real person who is falsely depicted the "viewed"?). We have supplemented the operator/viewed data by adding data about the general sentiments expressed in the work and the situation, and descriptions of the processes the machine vision is involved in. And by leaving data about the "viewed" blank when it is not relevant, we will be able to see what kinds of machine vision technologies do tend to be analyzable through the subject/object lens so common in twentieth century theory. Or perhaps we will find that in fact it is entirely possible to understand machine vision using this lens.

Combining distant analysis with close reading

Our way of combating the reductionism that will undoubtably occur using a distant reading approach is to *also* do close readings of works, which will be the next stage in the project. We hope that having worked in a structured way with a large number of works will make our more traditional interpretative analyses of individual works more productive.

How useful is such a database for other scholars?

Is this data that can be reused by others, or are the interpretations so tied to our particular project and group that another project would need to build their own database and coding schema from scratch? Could parts of the data be reused?

What are pros and cons of working collaboratively in the humanities?

The project is a collaboration between a professor, three PhD candidates and a research assistant. A co-authored paper will be part of the three PhD candidates' dissertation. What are pros and cons of this kind of quite intense collaboration?

Conclusion and more information

We are very much looking forwards to the opportunity to share this work at a stage where we have a lot to show, but are also still developing our methods, so that feedback will be very useful to us. We hope that exploring the database looking at possibilities for network analysis of the data will inspire participants to think about research ideas of their own and how they might use

For more details about the project, please see the project website, https://www.uib.no/en/machinevision, and our short paper *Mapping Cultural Representations of Machine Vision: Developing Methods to Analyse Games, Art and Narratives*, to be presented at ACM Hypertext 2019 in September. A preprint is available at https://mediarxiv.org/fvwm8/.

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