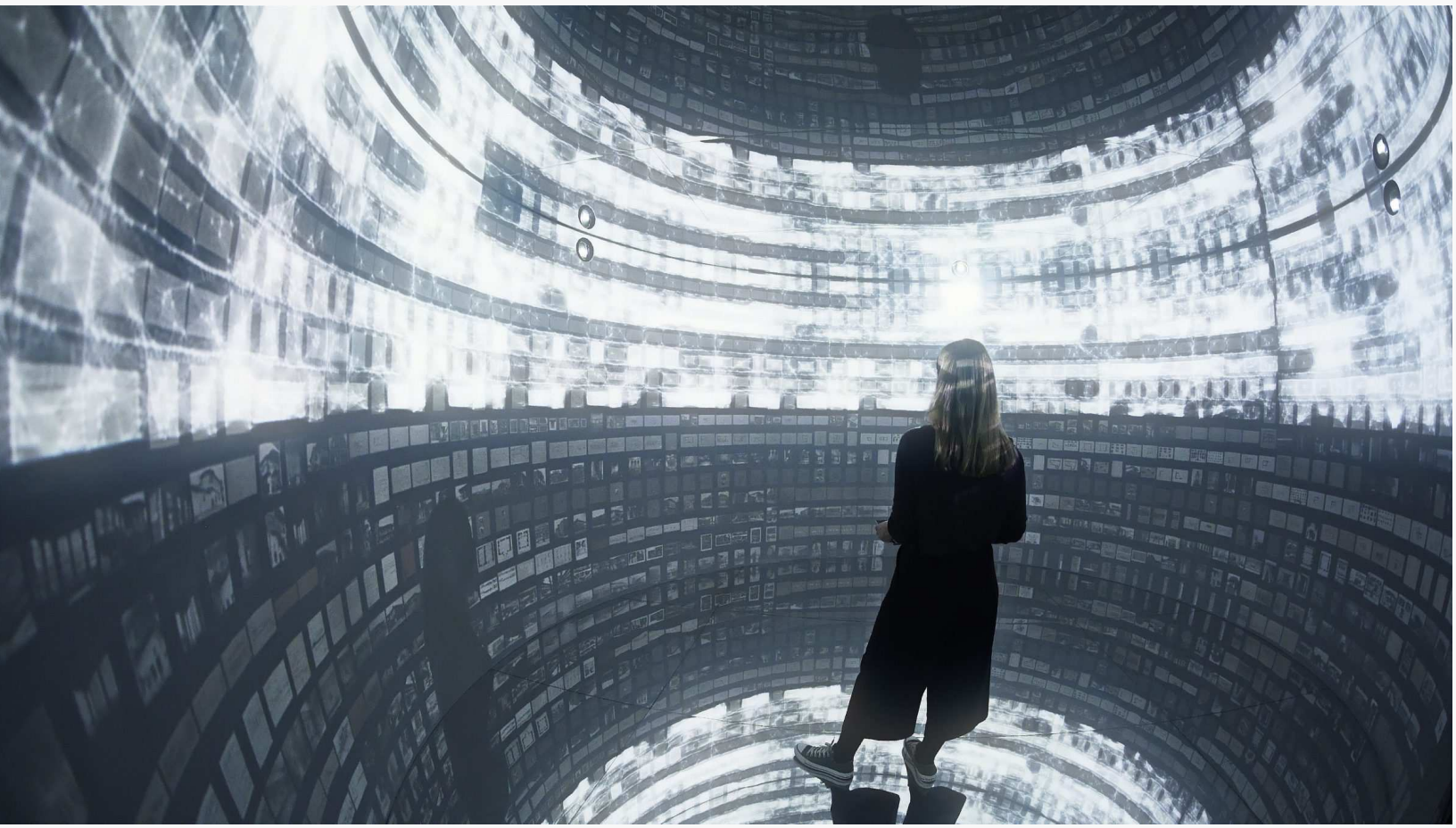
Museums &
New Intelligences

a primer for attendees

Prepared by the American Alliance of Museums



Archive Dreaming, installation view, SALT Galata, 2017. Image courtesy of Refik Anadol.

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Acknowledgements

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Cover Image:
Archive Dreaming
Installation view, SALT Galata, 2017
San Francisco, CA 02/03/2017
Refik Anadol
http://refikanadol.com/works/archive-dreaming

Introduction to this Convening

The nature of intelligence is changing.

As humans, our constant exposure to technology has already changed our relationship to knowledge, our approach to problem solving, and even our identity and concept of self. Now, the emergence of Artificial Intelligence (AI) promises to expand our abilities to learn, make predictions, automate routine tasks, and to navigate and translate across a range of human language and experiences.

Many museums are already using sophisticated data analytics and predictive modeling to improve their bottom line through practices such as dynamic pricing and the generation of highly accurate projections for attendance. Increasingly comprehensive datasets about our audiences, their preferences and behaviors, are improving museums' ability to personalize visitor experiences and connect to new audiences in deep and meaningful ways. Other museums are beginning to experiment with AI tools that supplement and scale the work of human staff in marketing, customer service, and interpretation.

But do those new found powers come with a price? The news is replete with stories about the privacy implications connected to the datasets these technologies rely on. Whereas the "cost" of personalization and "freemium" services have always been predicated on an exchange of data, it has become clear that this system is significantly flawed and vulnerable to manipulation, resulting in a growing wariness and mistrust of these technologies by the public.

We're excited that you can join us these next few days as we investigate these rapidly evolving intelligences and learn how museums might benefit from these technologies and manage the challenges associated with the growth of AI, machine learning, automation, and translation. Together with other senior leaders, artists, and scholars from inside and outside of the museum field we will consider the implications these technologies have on the practice, promise, and ethics of museums in the coming years. This is an opportunity to spend time with peers and experts to explore the opportunities afforded by these areas of emerging practice.

Introduction to Artificial Intelligence

Open the pod bay doors. -astronaut David Bowman
In 1968, Arthur C. Clark introduced audiences in the U.S. to perhaps their first encounter with a general artificial intelligence called the HAL 9000. Since that time, science fiction writers, Hollywood filmmakers and people everywhere have imagined and dreamed of what sentient computers might mean for the world.

I'm sorry Dave, I'm afraid I can't do that. -HAL 9000
Today, our impressions of machine intelligences are quite different. With advances in facial recognition, speech synthesis, and neural networks that can model and find solutions to many kinds of tricky problems - artificial intelligences are increasingly an integral part of our lives. More and more powerful computers, cheap digital storage, and ubiquitous access to the internet have fueled AI's recent progress and allowed scientists to break through computational barriers with surprising speed.

For museums, these technologies afford us with new tools that can help improve operating efficiencies, optimize attendance, and better understand the preferences and participation of audiences we are seeking to engage with better. How might the museum sector use AI, machine learning, natural language processing, and other techniques to advance our efforts to provide real benefits back to society and our local communities? What are the challenges and risks associated with doing so? And how can museums adopt and adapt these methods to best achieve our missions?

Overviews on AI and Machine Learning

The Quartz Guide to Artificial Intelligence: What is it, Why is it Important, and Should we be Afraid?
Dave Gershgorn. September 10, 2017.
https://qz.com/1046350/the-quartz-guide-to-artificial-intelligence-what-is-it-why-is-it-important-and-should-we-be-afraid/

The Fourth Industrial Revolution: A Primer on Artificial Intelligence (AI).
David Kelnar. December 2, 2016.
https://medium.com/mmc-writes/the-fourth-industrial-revolution-a-primer-on-artificial-intelligence-ai-ff5e7fffcae1

What is Deep Learning AI? A Simple Guide With 8 Practical Examples
Bernard Marr, October 1, 2018
https://www.forbes.com/sites/bernardmarr/2018/10/01/what-is-deep-learning-ai-a-simple-guide-with-8-practical-examples/#76ea90648d4b

Key Terms

All Key terms have been pulled from the AI Glossary, produced by the American Association for the Advancement of Science. The selection below includes the terms that are most likely to be referenced during the meeting.

For more vocabulary related to Artificial Intelligence, please visit:
http://science.sciencemag.org/content/357/6346/19

ALGORITHM
A set of step-by-step instructions. Computer algorithms can be simple (if it's 3 p.m., send a reminder) or complex (identify pedestrians).

BACKPROPAGATION
The way many neural nets learn. They find the difference between their output and the desired output, then adjust the calculations in reverse order of execution.

DEEP LEARNING
How a neural network with multiple layers becomes sensitive to progressively more abstract patterns. In parsing a photo, layers might respond first to edges, then paws, then dogs.

EXPERT SYSTEM
A form of AI that attempts to replicate a human's expertise in an area, such as medical diagnosis. It combines a knowledge base with a set of hand-coded rules for applying that knowledge. Machine-learning techniques are increasingly replacing hand coding.

GENERATIVE ADVERSARIAL NETWORKS
A pair of jointly trained neural networks that generates realistic new data and improves through competition. One net creates new examples (fake Picassos, say) as the other tries to detect the fakes.

MACHINE LEARNING
The use of algorithms that find patterns in data without explicit instruction. A system might learn how to associate features of inputs such as images with outputs such as labels.

NATURAL LANGUAGE PROCESSING
A computer's attempt to “understand” spoken or written language. It must parse vocabulary, grammar, and intent, and allow for variation in language use. The process often involves machine learning.

Key Terms Continued

NEURAL NETWORK
A highly abstracted and simplified model of the human brain used in machine learning. A set of units receives pieces of an input (pixels in a photo, say), performs simple computations on them, and passes them on to the next layer of units. The final layer represents the answer.

NEUROMORPHIC CHIP
A computer chip designed to act as a neural network. It can be analog, digital, or a combination.

REINFORCEMENT LEARNING
A type of machine learning in which the algorithm learns by acting toward an abstract goal, such as “earn a high video game score” or “manage a factory efficiently.” During training, each effort is evaluated based on its contribution toward the goal.

STRONG AI
AI that is as smart and well-rounded as a human. Some say it's impossible. Current AI is weak, or narrow. It can play chess or drive but not both, and lacks common sense.

SUPERVISED LEARNING
A type of machine learning in which the algorithm compares its outputs with the correct outputs during training. In unsupervised learning, the algorithm merely looks for patterns in a set of data.

TENSORFLOW
A collection of software tools developed by Google for use in deep learning. It is open source, meaning anyone can use or improve it. Similar projects include Torch and Theano.

TRANSFER LEARNING
A technique in machine learning in which an algorithm learns to perform one task, such as recognizing cars, and builds on that knowledge when learning a different but related task, such as recognizing cats.

TURING TEST
A test of AI's ability to pass as human. In Alan Turing's original conception, an AI would be judged by its ability to converse through written text.

Readings on AI from the American Alliance of Museums

TrendsWatch 2017

The 2017 installment of AAM's TrendsWatch report included a chapter on the role that Artificial Intelligence might play in museum practice which should serve as a useful primer to our discussions.

Artificial Intelligence - The Rise of the Intelligent Machine
https://www.aam-us.org/2017/05/01/artificial-intelligence-the-rise-of-the-intelligent-machine/

CFM and Alliance Blog Posts

Since that time, the Alliance Blog and the Center for the Future of Museums have published frequently on how museums are creating and adapting AI technology to advance the mission of museums.

IRIS+ - Designing + Coding a Museum AI
https://www.aam-us.org/2018/06/12/iris-part-one-designing-coding-a-museum-ai/

IRIS+ - How to Embed a Museum's Personality and Values in AI
https://www.aam-us.org/2018/06/19/iris-part-two-how-to-embed-a-museums-personality-and-values-in-ai/

Short profile of IBM Watson's Voice of Art Project
https://www.aam-us.org/2018/04/06/futurist-friday-chatting-about-art-with-ibm-watson/

AI and the Future of History
https://www.aam-us.org/2017/07/20/ai-and-the-future-of-history/

Readings on AI from the American Alliance of Museums Continued

Dispatches from the Center for Museums

These are links and abstracts to additional articles from CFM's weekly e-newsletter Dispatches from the Future of Museums. Interested in staying up to date with readings like this? Be sure to subscribe here: https://www.aam-us.org/programs/center-for-the-future-of-museums/dispatches-from-the-future-of-museums/

Bots Are About to Get Better at Customer Service than Humans
https://www.wired.co.uk/article/message-bot-customer-care

In 2018, AI-enabled bots will provide a better customer experience than human-to-human chat exchange, following the explosion of messaging services that have changed the way companies interact with their customers. Today, more than two billion messages are exchanged between people and companies every month on Facebook Messenger alone. Other major players have been investing heavily in the space, creating platforms to support companies in their pursuits to engage customers where they are and in the way they prefer. In 2018, this will give rise to AI customer-service agents that we are happy to deal with. Companies will learn that using AI-powered bots, supported by human "escape hatches", which seamlessly pass on the interaction to a human, will provide a vastly better experience than a standalone human-to-human exchange.

How AI Could Revolutionize Archival Museum Research
https://www.smithsonianmag.com/smithsonian-institution/how-artificial-intelligence-could-revolutionize-museum-research-180967065/

A just-published article in the Biodiversity Data Journal shows that some of the most exciting and portentous innovation in machine learning is taking place at none other than the National Herbarium of the National Museum of Natural History in Washington, D.C. The paper demonstrates that digital neural networks are capable of distinguishing between two similar families of plants with rates of accuracy well over 90 percent. The study relies on software grounded in “deep learning” algorithms, which allow computer programs to accrue experience in much the same way human experts do, upping their game each time they run. Soon, this tech could enable comparative analyses of millions of distinct specimens from all corners of the globe—a proposition which would previously have demanded an untenable amount of human labor.

Contemporary Readings and Resources

Searching for Privacy in the Internet of Bodies
https://wilsonquarterly.com/quarterly/living-with-artificial-intelligence/searching-for-privacy-in-the-internet-of-bodies/

Artificial intelligence, commonly referenced in acronym form, is a term that would have sounded entirely self-contradictory before its birth in the 1950s. At its core, what AI does is optimize data. Making sense of massive amounts of information curated by humans, machine-learning algorithms are trained to predict various aspects of our daily lives and reveal hidden insight in the process. But how are we able to first collect those mountains of data that feed AI? A primary way is through the Internet of Things, or IoT, a term that future-of-work expert Jacob Morgan describes as "the concept of basically connecting any device with an on and off switch to the internet (and/or to each other)." This pervasive network of sensors that captures data within our homes and cities is also in the process of morphing – and here's where the privacy issue really gets personal. The all-encompassing capture of our personal information – the quirks that help define who we are and trace the shape of our lives – will increasingly be used for various purposes without our direct knowledge or consent.

A Predictive Analytics Primer
https://hbr.org/2014/09/a-predictive-analytics-primer

No one has the ability to capture and analyze data from the future. However, there is a way to predict the future using data from the past. It's called predictive analytics, and organizations do it every day. Has your company, for example, developed a customer lifetime value(CLTV) measure? That's using predictive analytics to determine how much a customer will buy from the company over time. Do you have a "next best offer" or product recommendation capability? That's an analytical prediction of the product or service that your customer is most likely to buy next. Have you made a forecast of next quarter's sales? Used digital marketing models to determine what ad to place on what publisher's site? All of these are forms of predictive analytics.

Contemporary Readings and Resources Continued

Barnes Foundation uses intelligent machines to offer new ways of interpreting art collections
http://www.attractionsmanagement.com/index.cfm?pagetype=news&codeID=338394

Philadelphia's Barnes Foundation art gallery has used machine learning to create an intelligent art critic, with the technology able to interpret and pair digital artwork together to recognize art style, objects and even images of Jesus. Created to help users view the artificially generated art collections, the new AI can identify basic elements in an artwork – such as people, objects and animals – which it will then categorize and place in different artificially generated collections. A research team from Rutgers University created the technology, which at its core tries to ascertain visual similarity among objects. The AI differs from a recognition project created by Fabrica for the Tate, which is trained to recognize images using photographs, not art. By comparison, the Rutgers version understands the basics of art and will continue to learn as it takes in more images.

Artificial Intelligence Is Unlocking the Vatican's Secret Archives
https://www.theatlantic.com/technology/archive/2018/04/vatican-secret-archives-artificial-intelligence/559205/

The Vatican Secret Archives is one of the grandest historical collections in the world. It's also one of the most useless. Located within the Vatican's walls, next door to the Apostolic Library and just north of the Sistine Chapel, the VSA houses 53 linear miles of shelving dating back more than 12 centuries. That said, the VSA isn't much use to modern scholars, because it's so inaccessible. Of those 53 miles, just a few millimeters' worth of pages have been scanned and made available online. Even fewer pages have been transcribed into computer text and made searchable. But a new project could change all that. Known as In Codice Ratio, it uses a combination of artificial intelligence and optical-character-recognition (OCR) software to scour these neglected texts and make their transcripts available for the very first time. If successful, the technology could also open up untold numbers of other documents at historical archives around the world.

Contemporary Readings and Resources Continued

National Soccer Hall of Fame to use facial recognition for fan experience
https://www.frontrowsoccer.com/2018/08/21/a-hall-of-an-innovation-national-soccer-hall-of-fame-to-use-facial-recognition-for-fan-experience/

The National Soccer Hall of Fame and NEC Corporation of America announced a facial recognition-enabled guest experience for visitors to the Hall. NEC and the NSHOF are the first to use facial recognition technology to individualize a guest's experience in a sports and entertainment venue. Guests will benefit from facial recognition the moment they enter the Hall as they will be prompted upon check-in to share their hometown, favorite soccer position, favorite U.S. teams and their level of fandom. Based on that information, digital touch screens, virtual reality and gesture technology inside of the Hall of Fame will recognize guests using the NeoFace facial recognition software that will personalize each visit based on their individual preference.

Dot, the Akron Art Museum chatbot, wants to get you talking about art and life
https://www.cleveland.com/arts/index.ssf/2018/08/dot_the_new_akron_art_museum_c.html

She's smart, she's sassy, and she uses artworks at the Akron Art Museum to get you talking with your friends about art and life and the connections between the two. Meet Dot, the museum's new chatbot digital tour guide. She's got dark-frame glasses and a pink pageboy hairdo and she's been designed to spark conversations among museum visitors via texts on Facebook Messenger app, the social network's instant message function. Dot introduces herself as a guide who will take a squad of visitors through a six-stop "choose your own adventure" tour of the museum's permanent collection, pos[ing] questions designed to users talking to each other about life, not specifically about art.

Contemporary Readings and Resources Continued

Art Institute uses data to give visitors what they want
https://www.chicagobusiness.com/article/20180518/ISSUE01/180519840/art-institute-of-chicago-uses-data-to-make-exhibit-choices

If you saw “Degas: At the Track, on the Stage” at the Art Institute of Chicago in 2015 or early 2016, you were part of an experiment. The show, a microcosm of the impressionist artist’s work, used a sophisticated attendance model to test the effect of smaller exhibits on attendance. Measuring Wi-Fi usage throughout the museum revealed that visitors spent more time in the room containing the Degas exhibit than they would have had that room not contained a special exhibit. Thanks to that experiment, the Art Institute has stepped up smaller exhibits, opening a new show, on average, every two weeks. They hope these exhibits will bump up the 60 percent annual renewal rate for its 100,000 members. The new plan will also give the museum a break from the time and expense of blockbusters. The audience analytics program behind the more-and-smaller strategy is built on visitor ZIP codes as well as 10 different attendance models.

Artificial Intelligence Technology Landscape
https://www.callaghaninnovation.govt.nz/sites/all/files/callaghan-innovation-infographic-artificial-intelligence.pdf

This infographic from Callaghan Innovation breaks down the technology landscape for Artificial Intelligences and provides a portfolio of its applications.

Online AI Tools and Interactives

Google Arts and Culture App
https://artsandculture.google.com/camera/selfie

The app uses facial recognition technology to create a scan of the user's face, identifying unique characteristics (e.g., the size of your eyes or the space between nose and mouth). It then attempts to match those features to the collection of over 70,000 paintings and other pieces of art in its database.

Betaface
https://betaface.com/demo.html

Upload one or more images, click action buttons to see processing conclusions about image content, classification (age, gender, ethnicity, smile, attractiveness, etc.) Can be used to search for similar faces on Wikipedia or on Betaface's own database of celebrities.

Mitsuku
https://www.pandorabots.com/mitsuku/

A chatbot and recent winner of the Loebner Prize (an annual competition for artificial intelligence that awards prizes to the chatbot judged to be most human-like.)

Insomno bot
http://insomnobot3000.com/

Another chatbot example, designed to keep you company when you can't sleep. Works via text messaging.

Sentiment Viz
https://www.csc2.ncsu.edu/faculty/healey/tweet_viz/tweet_app/

Sentiment viz uses a keyword you select to pull recent tweets from Twitter, and creates a visual map of the resulting dataset. These visualizations include sentiment (characterizing the emotions of the tweets), topic clusters, heatmap of pleasure and arousal, tag cloud (showing common adjacent words), geographic map of tweet origins, affinity (frequent tweets, people, hashtags, URLs showing interactions with the keyword), and narrative (following a time ordered sequence starting with a selected anchor tweet).

Online AI Tools and Interactives Continued

Watson Discovery News

https://discovery-news-demo.ng.bluemix.net

This news and trends analysis platform operates on approximately two months' worth of news and blog content. It finds people, companies, and topics in the articles, interprets positive and negative sentiment, and it shows trends and anomalies.

Watson Visual Recognition

https://www.ibm.com/watson/services/visual-recognition/demo/#demo

This service recognizes a broad variety of objects and image characteristics, such as color and texture. It also finds faces and estimates ages and gender.