



Machine Learning: An Introduction With Python

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Outline for the Day

Overview of Artificial Intelligence (AI) and Machine Learning

Historical Context of AI and Art

Demos and worksessions

Lunch Break

ML Shortcomings

Demo: Advanced Model

Demystify ML

Inspiration and closing notes

Your presenters today

Lorne Schell (he/him/i)

Applied Research Scientist in Machine Learning with 10 years experience across industry.

You cannot fully understand what you have not experienced

Through art is the most experiential way to understand the capabilities and limitations of statistical and deep learning models.

Mattie Tesfaldet (they/them/ie)

Computer vision researcher and artist based in Montréal (originally from Toronto). They are pursuing their PhD at McGill University, researching generative models for visual content creation. They enjoy applying their research with the aim of exploring the intersection of human creativity and artificial intelligence.

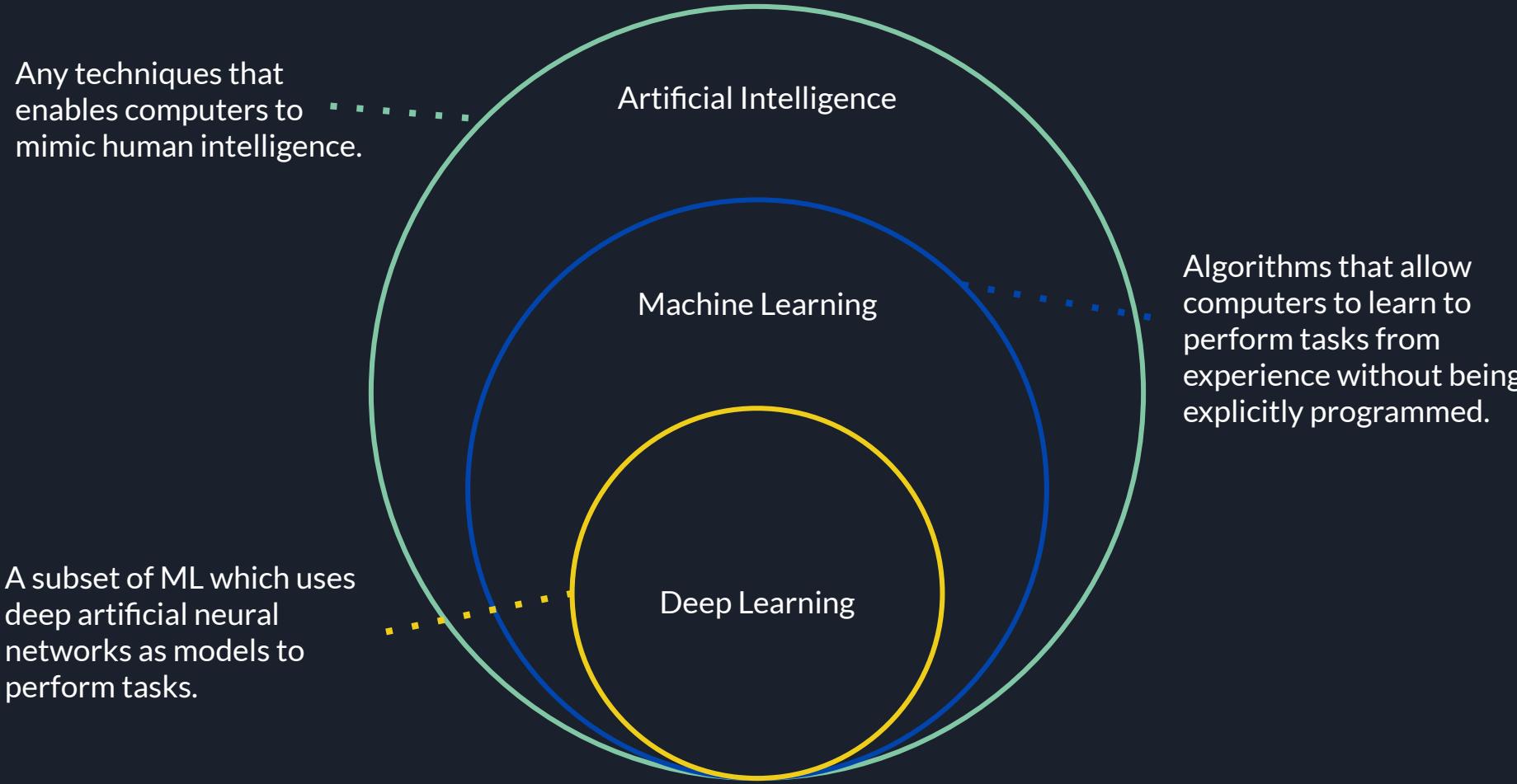
Edith Viau (she/her/elle)

Artist based in Montréal (Qc) interested in numerical arts, algorithms, programming, mathematics and finance. Founder of the ARTificial (artificial.st) project and of the finartcialist project.





Overview of Artificial Intelligence and Machine Learning



Any techniques that enables computers to mimic human intelligence.

Artificial Intelligence

Machine Learning

Deep Learning

A subset of ML which uses deep artificial neural networks as models to perform tasks.

Algorithms that allow computers to learn to perform tasks from experience without being explicitly programmed.

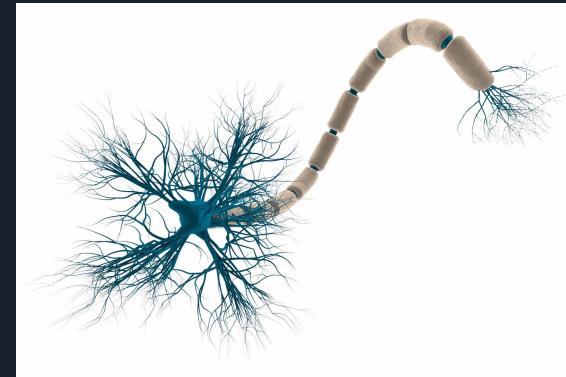
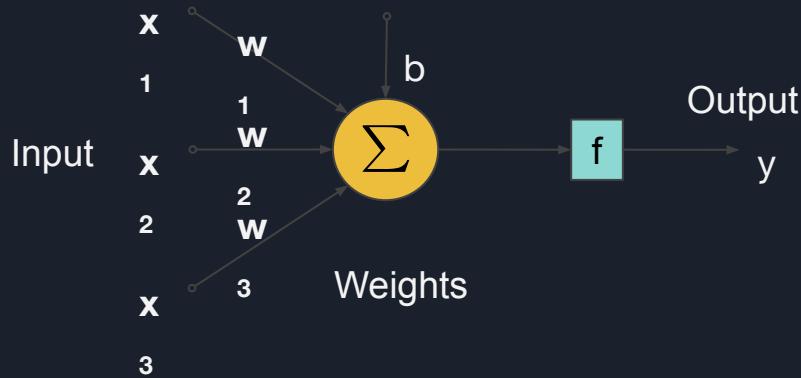
What is Machine Learning?

Programming a computer with data instead of code

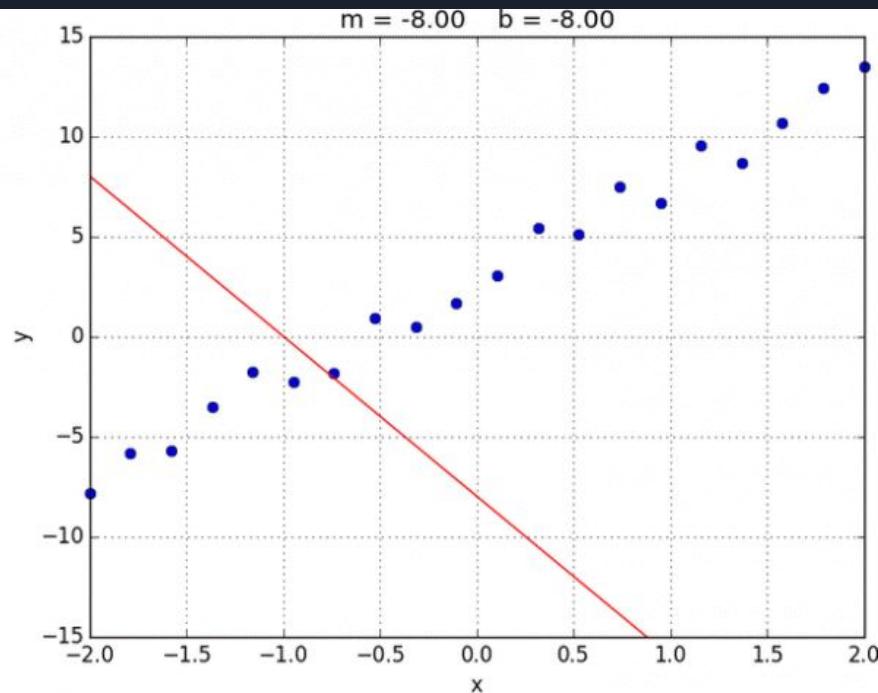
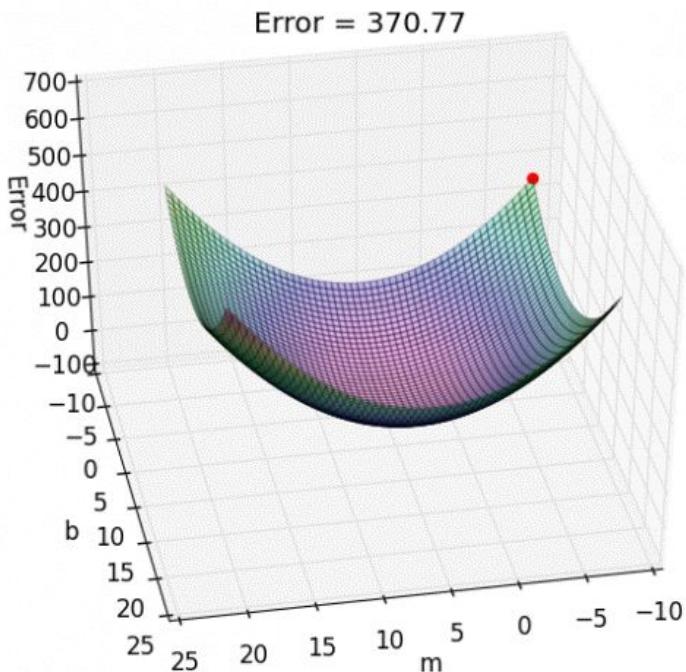


What is a Neural Network?

It is a Machine Learning model inspired by a neuron

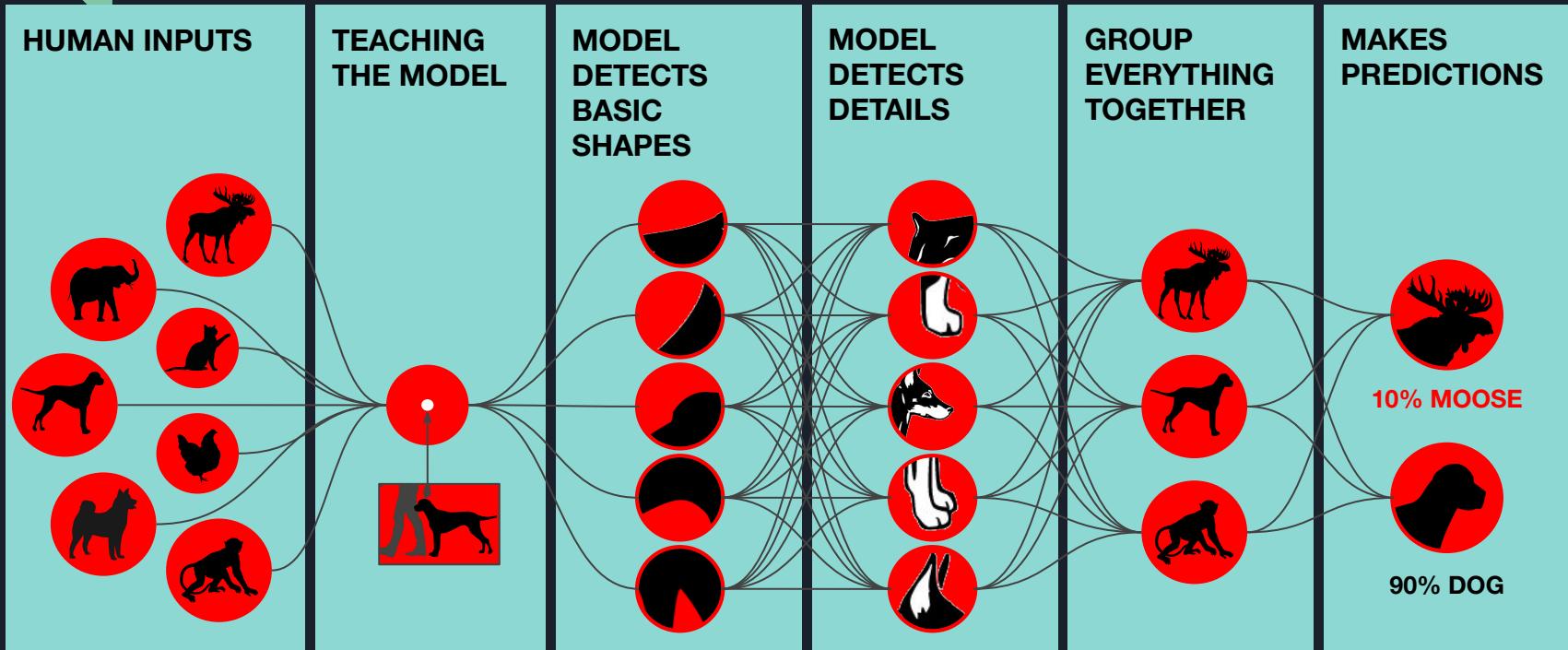


How a neural network is made



How does it work?

Attributing importance to the features of our training data

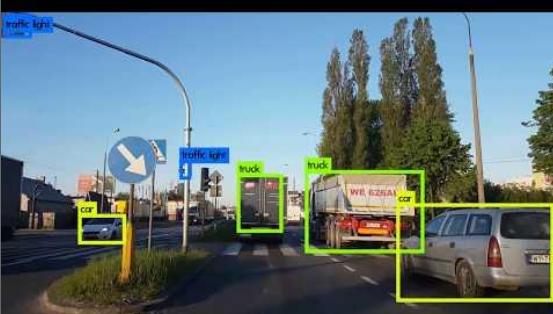


How can we use it?

Programming a computer with data instead of code

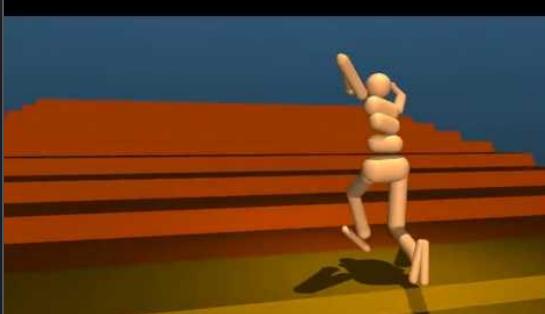
SUPERVISED

Learning known patterns



REINFORCEMENT LEARNING

Learning actions from rewards



UNSUPERVISED

Learning unknown patterns





Historical Context of AI and Art



Historical context of AI and Arts

Greek mythology:

- Talos, a bronze giant
- Pygmalion and Galatea, a statue that comes to life

China:

- Yan Shi's mechanical men

Middle East:

- Ismail Al-Jazari's book on automatas



Precursors in AI and arts

Claude Shannon

- Theseus: a mouse labyrinth

<https://techchannel.att.com/play-video.cfm/2010/3/16/In-Their-Own-Words-Claude-Shannon-Demonstrates-Machine-Learning> (3:30)



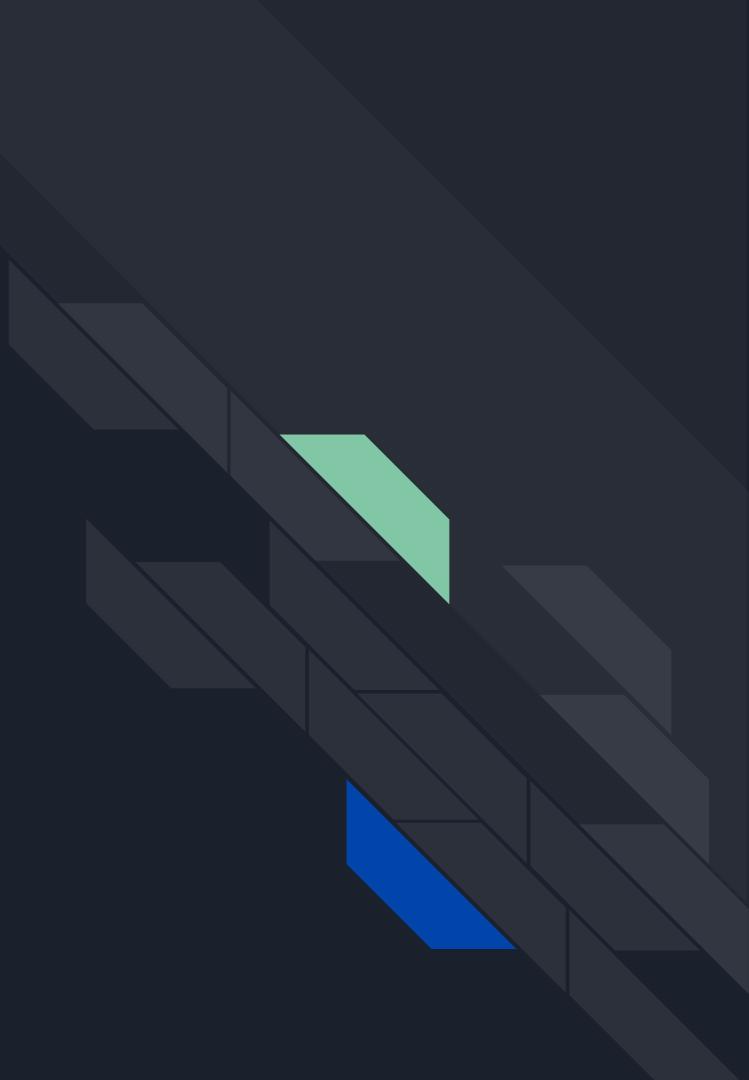
Precursors in computer arts

Sol LeWitt

- “The idea becomes the machine that creates the art”
- *Wall Drawings*, a serie of human-generated procedural drawings:
<https://www.youtube.com/watch?v=gaMgraAvQww>(MIT List Center Student Lending Art Collection Highlight: Sol LeWitt, Wall Drawing # 869B)

Working Session

Get Setup





Installing git

Go here: git-scm.com/downloads and install the version for your OS

```
git config --global user.name "Your Name"
```

```
git config --global user.email "your.email@your.provider.ca"
```

Then clone our repository:

```
github.com/orangetoaster/automachine/
```

```
git clone git@github.com:orangetoaster/automachine.git
```



Setting up Python with miniconda3



Demo 1

Adding numbers with Keras



Adding numbers with a neural network

We will add randomly generated numbers with a neural network.

We will need one Dense layer : <https://keras.io/layers/core>

It takes two inputs and output a single value.

We train the neural network with *model.fit* and we make predictions with *model.predict*.



Adding numbers with a neural network

Code : <https://github.com/orangetoaster/automachine/blob/master/models/basicmodel.py>

To run the code:

- Copy the code into your repo, if the repo is not yet cloned
- On the command line:

```
python3 basicmodel.py
```



Adding numbers with a neural network

Try playing with the *epochs* and *batch_size* parameters to see if it changes anything.

Does training with more examples help ?



Introductory model

Generating images with
DeepDream

Generating images with DeepDream

What is DeepDream ?

“Again, we just start with an existing image and give it to our neural net. We ask the network: “Whatever you see there, I want more of it!””

References:

<https://ai.googleblog.com/2015/06/inceptionism-going-deeper-into-neural.html>





Generating images with DeepDream

One of the way we can use machine learning for arts is by using pretrained models.

To use pre-trained DeepDream, first, find an image in JPG/JPEG format that you want to use DeepDream on.



Generating images with DeepDream

A pre-trained DeepDream is available on Keras.

Code : https://keras.io/examples/deep_dream/

Command line prompt:

```
python3 deep_dream.py name_of_your_image.jpg result_name
```



LUNCH BREAK



ML Shortcomings



Machine Learning shortcomings

Distribution Drift, what does it mean?

- Assumptions that exist in the data no longer hold in a new situation or into the future



Machine Learning shortcomings

Data Representativeness

- When the data was collected, does it say what you think it says?



Machine Learning shortcomings

What you train for is what you get.

- If you discard outliers, then you won't be able to model atypical situations.
- If you optimize for the average, then your model won't care about non-averages



Machine Learning shortcomings

No universal model in theory - and no perfect hybrid of constraints and statistics in practice

Consider the adding network that we trained at the beginning. We know the true answer which is well defined - not a fuzzy concept. But statistically the model will always make some amount of error.

Machine Learning shortcomings

Accidental assumptions are still assumptions that are made

Firetrucks are red.

Sentences have subjects.

"So far so good"



Machine Learning shortcomings

Some things aren't predictable



Chihuahua or blueberry muffin?



Adding numbers with a neural network

Try playing with the *epochs* and *batch_size* parameters to see if it changes anything.

Does training with more examples help ?



Advanced Model: Transformers

Eat the Data

Generating text with GPT2 transformer

What is a Transformer Model ?



Fine Tuning to get outputs that you want

What is Fine Tuning?



Changing output parameters

The model is one part of the overall work; context and delivery is important.



Final Working Session

Eat the AI



Demystifying ML



Demystify machine learning for the arts

Do we need a lot of data ?

- Not with all models or tasks: e.g. reinforcement learning does not need data
- May use pre-trained models for specific tasks instead
- Creating new datasets is part of the process
- Using old datasets in new ways can be interesting
- See a list of datasets repositories in the references



Demystify machine learning for the arts

How much mathematics / computer science knowledge is needed ?

- Mathematics: linear algebra, calculus, statistics are used and can be helpful
- A lot of the math is integrated in the frameworks: might need specific knowledge to tweak parameters, but no need to know everything if you use a prebuilt, or a pretrained model
- See references at the end



Demystify machine learning for the arts

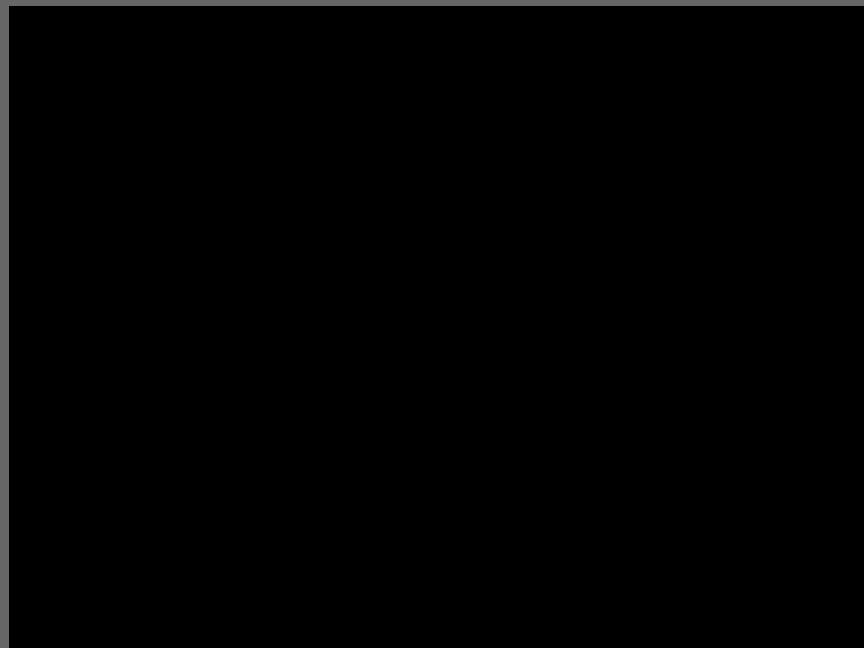
Do we need a really powerful computer to train or run models ?

- Some models really need a GPU to train/run
- A lot can be done with only a CPU as we showed in this workshop
- You can access GPUs through cloud services (\$)
- References at the end



Inspiration

Anna Ridler

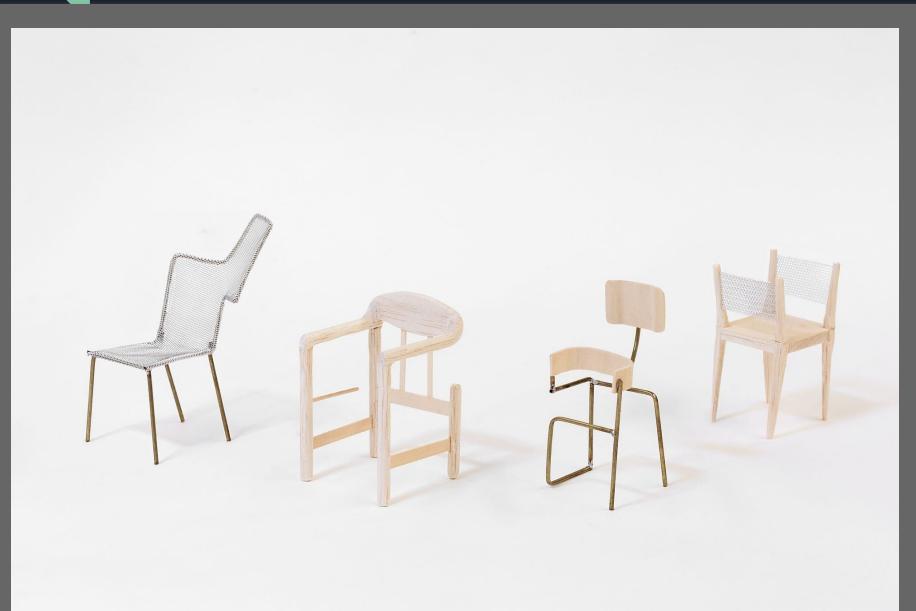


[Tulip Mania meant that] the order of the stock market was introduced into the order of nature. The tulip began to lose the properties and charms of a flower: it grew pale, lost its colours and shapes, became an abstraction, a name, a symbol interchangeable with a certain amount of money."

Zbigniew Herbert

To generate new flowers based on bitcoin's price, Ridler trained a generative adversarial network, or GAN, using her painstakingly constructed data set.

Phillip Schmidt



By positioning machine and human in reverse of their usual roles (The machine creates, the human produces), the work challenges creativity as an exclusively-human (or at least non-machine) trait, calling into question the modernist divide between man and machine — not as an insult, but as an opportunity.

I just published Humans of AI [...] It exposes the myth of magically intelligent machines, instead applauding the photographers who made the technical achievement possible.

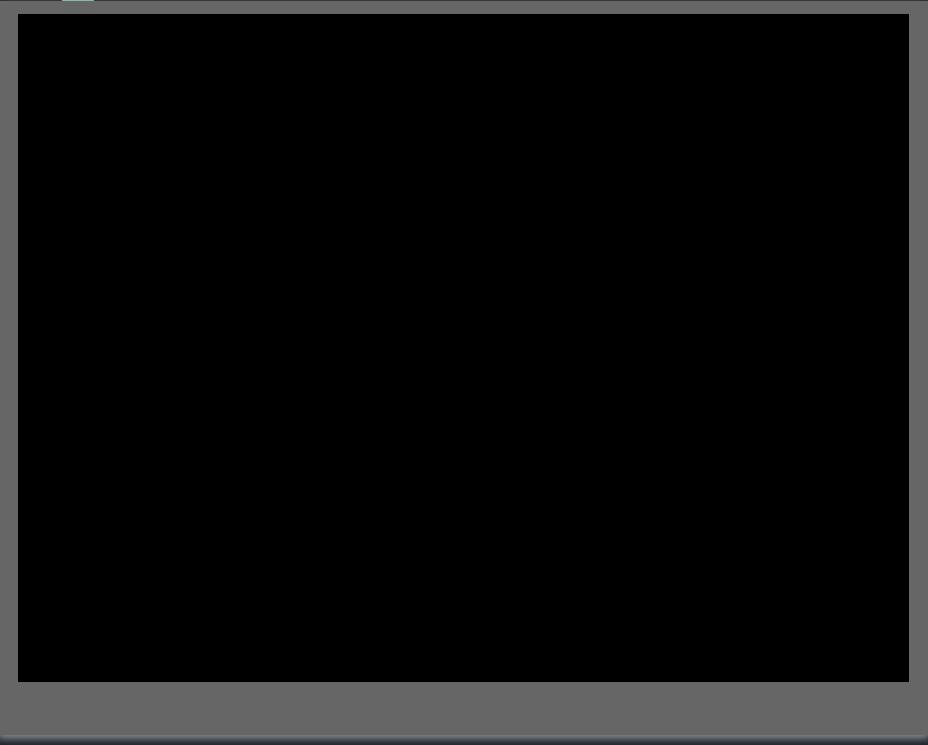
Mat Chivers (matchivers.com)



Migration signals one of the first times that an AI has been used to generate a three dimensional form derived from machine learning. The AI has created the impression of a hand although it has no physical hand itself.

For hundreds of thousands of years, human beings have made tools, and those tools have shaped us in return.

Vincent Morisset



Vast Body is an ongoing experiment on movement. Our collaborators were invited to imagine and embody, in front of a camera, a wide spectrum of postures that Vast Body's artificial neural network can "see" and understand. In the installation, the alter ego continuously tries to replicate the upper-body movements of the visitor facing it. Vast Body performs its own interpretation of the visitors' behaviours.

It's about the limit of human imagination, and also the limit of the computer vision system. [...] to show their different personalities and to highlight your own. At one point, you become the other.



Tom White



Rafael Lozano-Hemmer



Mimi Onuoha



Sarah Friend



Lucas LaRochelle



Future Notes

After this workshop

- Link us to your future projects so we can include you on the repo if you so wish



Join us for drinks





References

See github for full references !

<https://www.github.com/orangetoaster/automachine/references.md>



Understanding the problems

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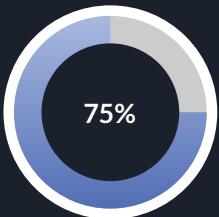
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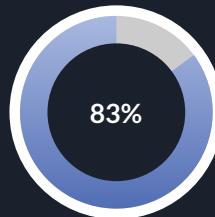
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Wendy Writer

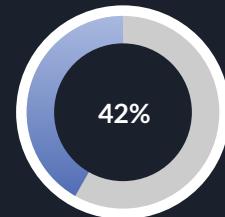
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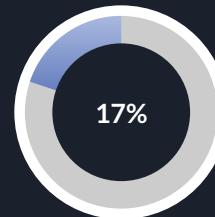
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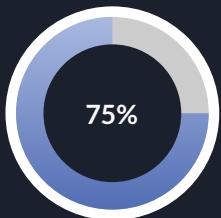
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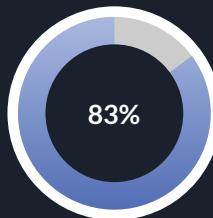
Persona 02

Berry Books

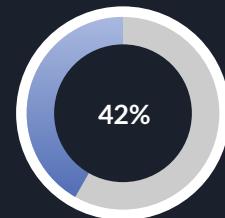
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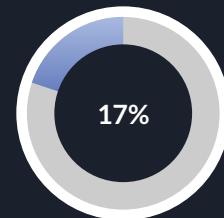
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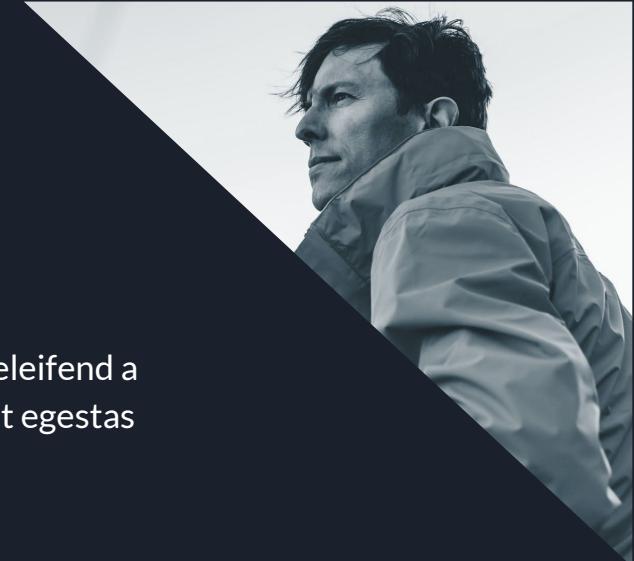
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Market trends

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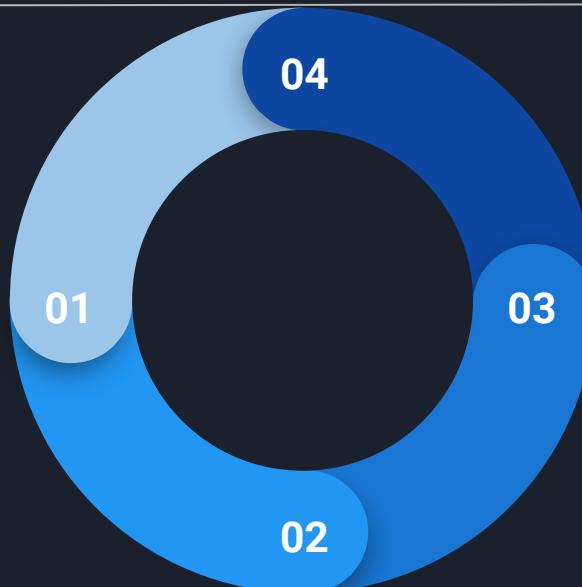
Cycle diagram

Prototype

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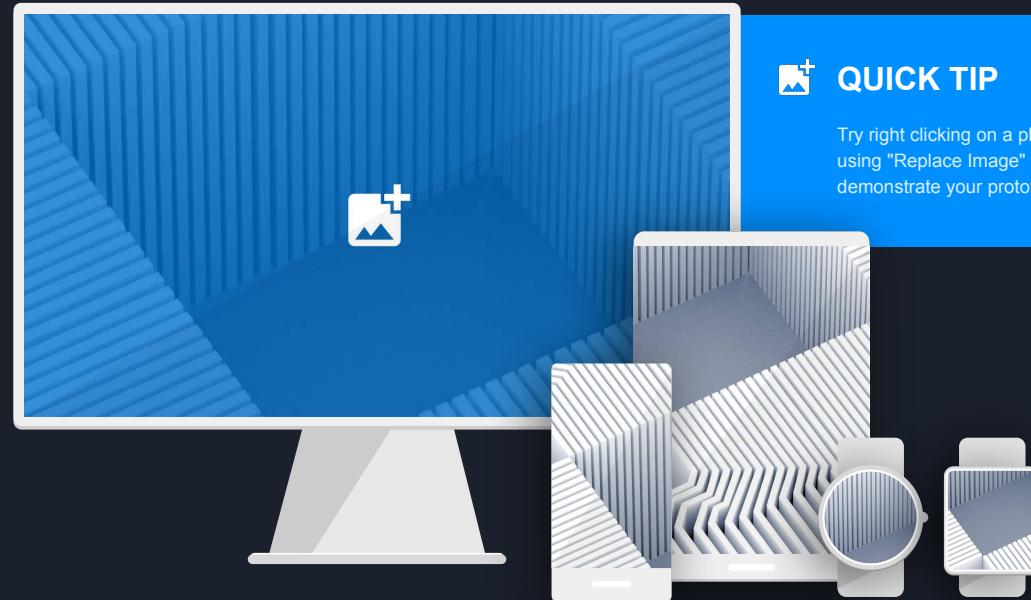
Get feedback

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Introducing: Lorem ipsum

Showcase how your tools work across different devices

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Spotlight on desktop

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Spotlight on mobile

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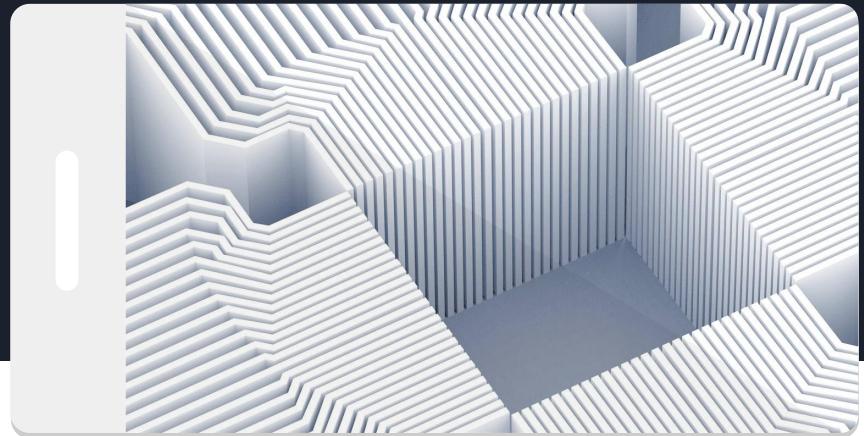
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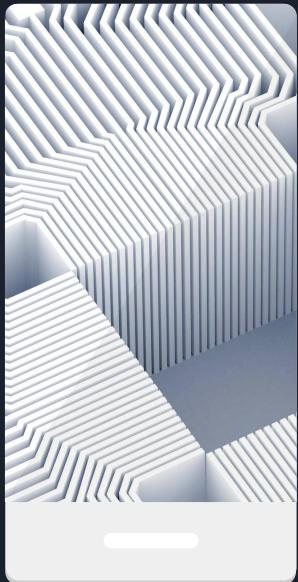
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Spotlight on wearables



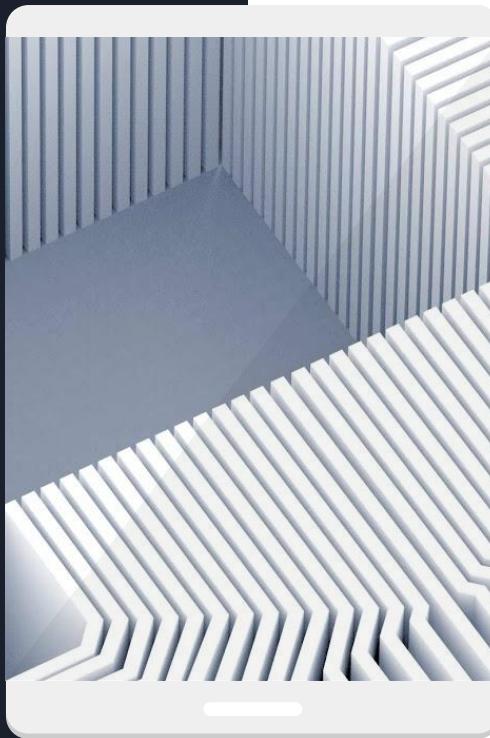
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Spotlight on tablet

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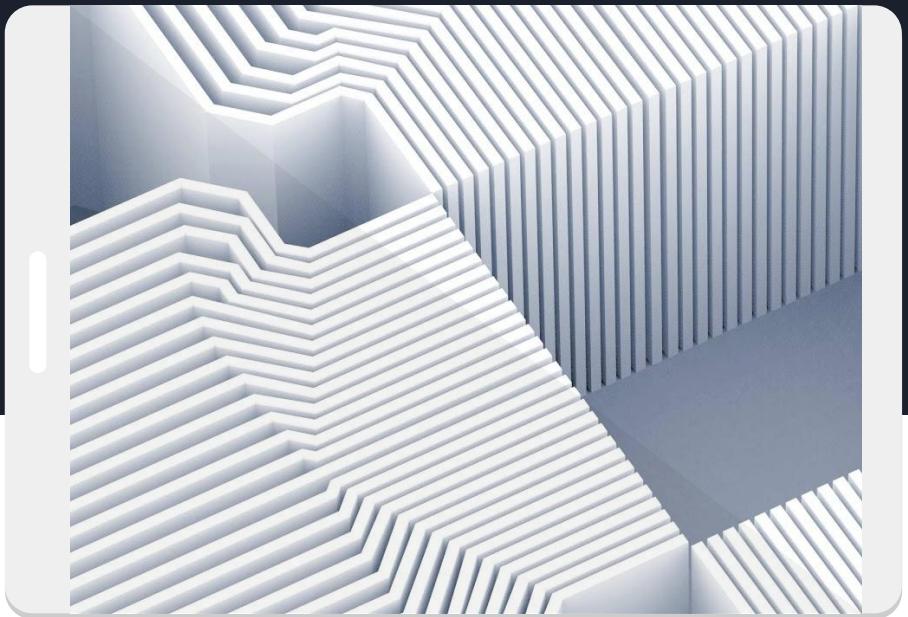
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Spotlight on landscape view on tablet

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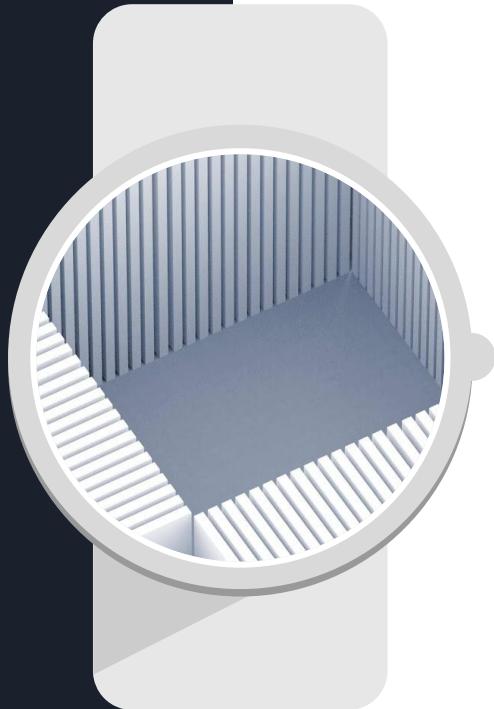
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Spotlight on wearables

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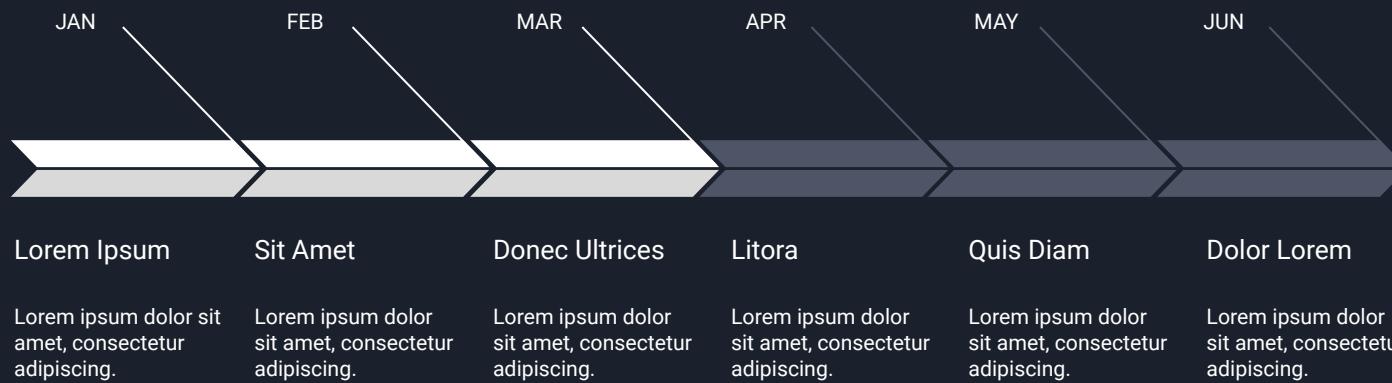
Spotlight on wearables

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Project timeline





Thank you!

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