



C1A0

Artificial Intelligence Exposition

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L'evoluzione della Computer Vision nell'era neurale: scienza & impresa

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AGENDA

- WHO?
- NEURAL AGEs
- DTC EVOLUTION
- **CYCLOPEYE:** the «neural» sensor
- EXTRAs
- Q&A









FOCUSED ON COMPUTER VISION

■ POINTERS TO SOURCES

■ NO FICTION









ARGO Vision is a startup that excels in **Computer Vision** and **Machine Learning**. We develop innovative and high-customizable AI-based solutions to **boost your business up**.

The ARGO Vision AI is empowering up dozens companies worldwide. Our engine is boosting firms in AR/VR, Smart Parking, Video-Analysis and Big Data solutions.





Skills and highlights



Computer Vision



Deep Learning



Proprietary Code



One Engine, Many Markets



Open Innovation is a Mantra



Customization and Flexibility

Awesome features



Technological independency

Financial independency

>80% long-term projects

Numbers matter

15,000+

Sensors using our technology

600+

Sensors using our AI engine

20+

Succesful projects since 2016

25

Scientific publications

People in the R&D team

20+

Training courses

We Teach Stuff

Programming

- Java web-services / EE
- Java beginner / expert
- C++ beginner / expert
- C# beginner / expert
- C beginner / expert
- JavaScript
- Python
- PHP
- more...

Technology

- Linux beginner / expert
- Linux device drivers
- Android expert
- Matlab/Octave
- Tensor Flow
- Spark / Scala
- MongoDB
- Spring
- more...

Science

- Big Data (Hadoop stack)
- Machine Learning w/ R
- Artificial Intelligence
- Computer Vision
- Cloud Computing
- Neural Networks
- more...







NEURAL AGEs

The proto-age The '40s to 2012 **First wave** The 2012 to present **«Conscious» age** The 2020: what's next?





#history

Late '40s: McCulloch–Pitts, the artificial neuron.

The '50s: Rosenblatt, a successful use case.

Late '60s: Minsky and huge limitations to AI.

The '90s: Hinton & LeCun, the fathers of "deep".

















#2012

"ImageNet Classification with deep convolutional neural networks" **destroyed** old school methods.

A mix of standard concepts (convolutional layers, pooling) with new insights (GPU, ReLU, Dropout).

The CNN error rate was **%15.3**, whereas the second closest was **%26.2**. Whoa!







six folk facts

#Rockstar

Al Scientists are media rock stars. A clip on youtube can reach for Millions views.

#Canada

Montreal seeks to be the world leader in AI research. Bengio is growing the next gen. of talents.

#Leadership

Al pioneers have left academia and entered the business world (LeCun, Andrew Ng, etc.).

#Perception

Neural approach offers the higher accuracy ever. Often better than humans. Magic?

#Dataset

A better (not only bigger) dataset is stronger than any good algorithm.

#Technology

GPUs , many open frameworks, thousands github projects, Gb of pre-trained models, etc.



EVOLUTION

the DTC paradigm



























Detection, Tracking and Classification of instances of semantic objects of a certain class (such as faces, humans, cars, etc.) in digital images and videos













#detection





OpenCL detector (c) 2011 Michal Hruby Divide Referees TX 285 Execution of 6 kernels: 55063 us Total frame time: 61.1721 ms (16 fps) Frame grab: 6.51234 ms



#description WH .GOV more OF THE TILLITY.

#analysis





#transfer

<u>more</u>









#generation

256x256

3 days 18 hours

6.78M reals shown

#generation (scary)





#generation (scary)





#generation (scary)





Which is real?

LET'S PLAY













Humans

TLH: [NaN 5.00] Time: 0.01 sec Disp: 1 Frame: 22

A NOT







Adversarial Attacks

#History

In 2014, a group of researchers found that it was easy to fool ConvNets with an imperceivable noise addition.

#Stickers!

In 2017, the attacker does not need to know the image they are attacking when constructing the attack.

#What?

Misclassification and false negative detections are the most interesting AA. Very dangerous!

#Confidence

imperceptibly little noise fools the system but it is not enough to fool us, the humans. Worst case!

#How

Adding noise, light aberrations / orientation or fooling "objects" (i.e. glasses) to the input. Too much simple.

#Transferability

the AA not depend much on the specific NN used - an AA pattern trained for one network seems to confuse another one as well



57.7% confidence

99.3% confidence

Physical attacks



"Milla Jovovich"



Fails to see stop sign















-





Q: an algorithm *really* detect faces?



BOOSTED CASCADE

Viola and Jones

The **Viola–Jones object detection framework** is the first <u>object detection</u> framework to provide competitive object detection rates in real-time proposed in 2001 by <u>Paul Viola</u> and <u>Michael Jones</u>.^{[1][2]}

Although it can be trained to detect a variety of object classes, it was motivated primarily by the problem of <u>face detection</u>.

- **Performance:** Fastest and most accurate ever, adjustable for other rigid objects (cars, humans, etc.)
- Features: One-class limitation, it's a binary classifier.
- **Idea:** Haar features, integral image and early rejection approach.





The anti make-up 2017


Tap to n



From fashion to Hong Kong 2019





LET'S RECAP

Evolution

From bounding box to more sophisticated description. The ultimate goal is the world comprehension. Semantic!

Trends

Many of the most important problems still remain open, both in terms of theory and in terms of applications.

Framework

Detection, tracking and classification not separated anymore. One problem, one framework.

Accuracy

NNs offer the highest accuracy ever in DTC. In some challenges, better than humans (i.e. face recognition).

Dataset From descriptive models to

generative frameworks. Virtual data and labeling is the new frontier of NN improvement.

GPU

GPU is a winning factor. All the "amazing" clip you have seen is thanks to GPUs acceleration (Nvidia / CUDA)

Neural Parking (AGLA Group, powered by ARGO Vision)

Financing a venture Italian eco-system (2018)

<0.3B € - Top 15 Italian venture investments



110B € (360x) – only "virtuous" PMIs (approx. 52,000)













PARKING GUIDANCE SYSTEM



CyclopEye Sensor







the neural assistant

Devices

- 4-6 lots per device
- PoE, low power
- 2 HD cameras
- Smart led

Services

- Space occupancy
- Find your car
- Analytics
- Profiling

Features

- **Fully proprietary SW**
- Accuracy: >99%
- **Proprietary HW**
- Fully stand-alone









Prototype (2016)

- Up to 4 lots per device
- Old-school classifiers
- Accuracy: up to 85%
- Dataset: 5k samples
- Training time: 1-5 dd

Release 1 (early 2017)

- Up to 6 lots per device
- Embedded Neural
- Accuracy: up to 97.0%
- Dataset: 50k samples
- Training time: 5-10 dd

Release 2 (late 2017)

- Up to 6 lots per device
- Embedded Neural ++
- Accuracy: >99%
- Dataset: 2M samples
- Training time: 1-5 dd

Release 3 (2019)

- Up to 6 lots per device
- More General Net ++
- Accuracy: >99.8%
- Dataset: 3M samples
 - Training time: <12 hrs.

more



5000+ Monitored lots up to 1M+ events / day

drive customers from digital to physical

Basic	Advanced	Ultimate
LED assistant	"Passive" Analytics Find-Your-Car	Parking Reservation Customer Care ++ Third-party mktg ++ Car Sharing ++
Revenues	Revenues+	Revenues++

The Smart Parking Competition

	AGLA Group (powered by ARGO Vision)	Spain	US_1	US_2
Vision Sensor	\checkmark	\checkmark	\checkmark	×
UltraSonic	\checkmark	×	×	\checkmark
In-ground	\checkmark	×	×	\checkmark
Smart lights	\checkmark	\checkmark	X	\checkmark
Info Panels	\checkmark	\times	\checkmark	\checkmark

Installed sensors over time







HOW FAR FROM ARTIFICIAL INTELLIGENCE?

https://www.youtube.com/watch?v=fa5QGremQf8

how easy do you think lipreading is? let's give it a try



os://www.youtube.com/watch?v=fa5QGremQf8



Sentence: Place blue in m 1 soon LipNet: Place blue in m 1 soon



00:22.10

PERFORMANCE?

Human: 52%

LipNet: 93%

Contact

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