

Digital Perception and Human Perception

Nizar Ouarti

Associate Prof., IPAL, Sorbonne UPMC
CNRS Delegation
Singapore

CNRS

- CNRS is one of the best ranked institute worldwide in term of research publications and applications of research.
- CNRS is dedicated to research with no obligations to give courses for the researchers.



Sorbonne UPMC

- University of Sorbonne UPMC, is the best ranked university in France and one of the best in Europe.
- It is located in the center of Paris



Which Digital Perception?

- What is digital perception?
 - I define it as the abilities of a numeric system to sense and interpret the surrounding world
- Is it better to be bio-inspired or bio-mimetic?
 - Bio-inspired systems consist of taking some inspiration from Nature and proposed new concepts based on these observations.
 - Bio-mimetic systems have the purpose to mimic Nature and to be an exact copy of some biological mechanisms.

Stereovision

- Stereovision is a triangulation based on 2 images.
- Humans have two eyes and can perceive the depth thanks to the disparity between the two views (finger experiment).
- With two cameras, it is also possible to obtain the depth



Depth: robot drainbot

- Robot: Drainbot collaboration with NUS

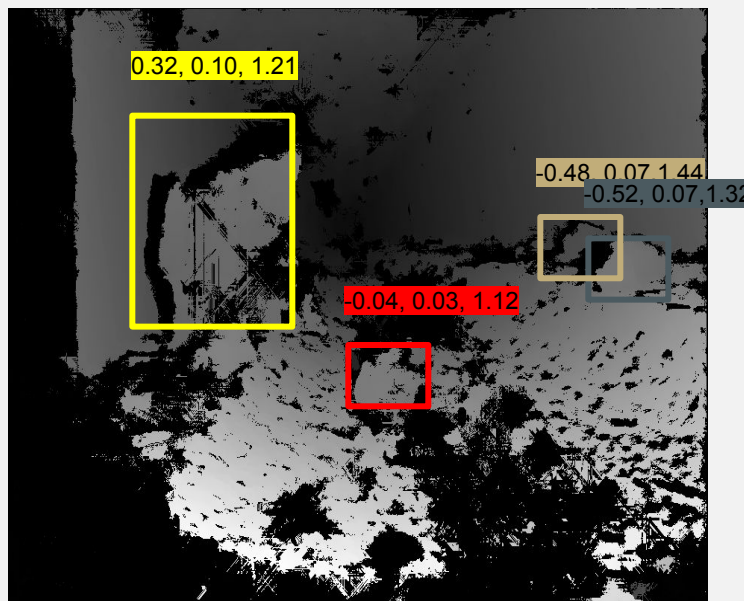


Extreme conditions

Input Image

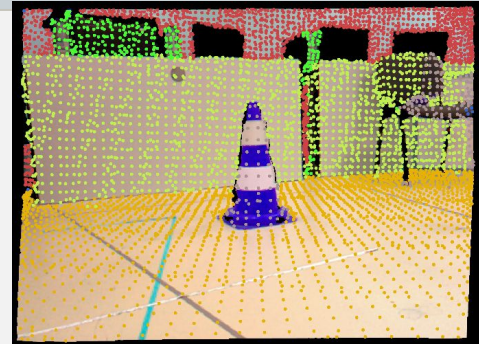


Depth Map



Indoor detection

Carte de
profondeur+RGB

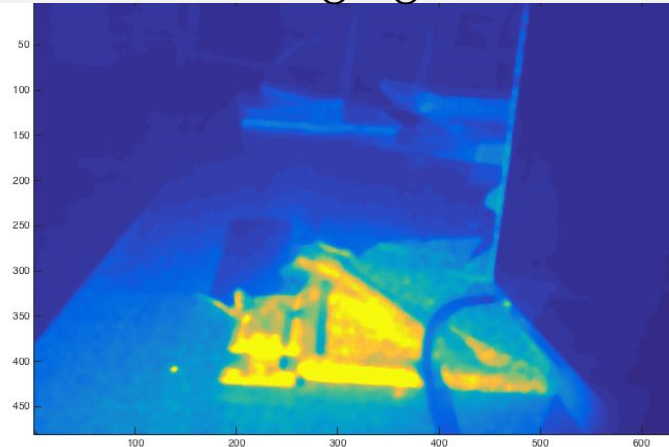


Centre de masse
position 3D

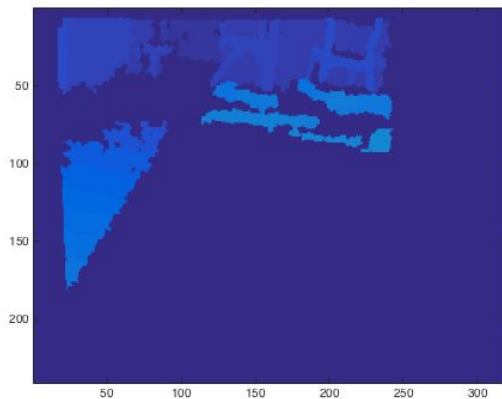


Comparison between Kinect and my results

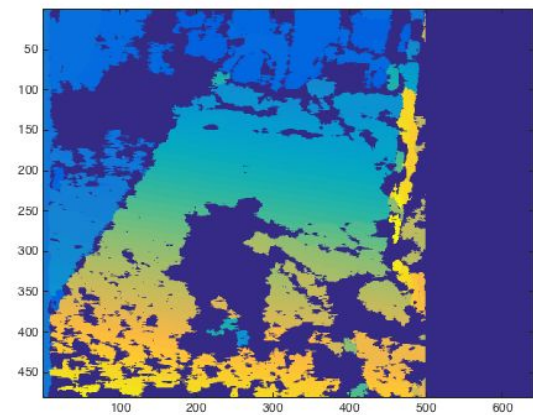
Challenging scene



Kinect results



My results



Stereovision

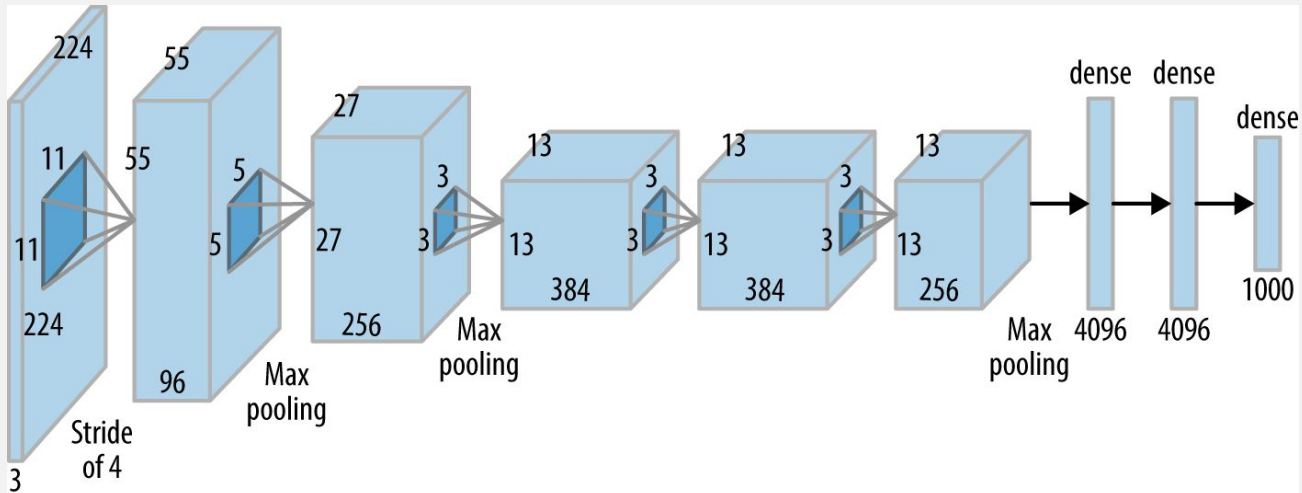
- Stereovision was initially inspired by Nature
- Many algorithms that appeared afterward were not connected at all with biology
- Computationally speaking, the brain still outperforms computers for realtime processing
- New approaches inspired by the brain begin to appear in stereovision.

IA and Deep Learning

- *Deep Learning* is a new trend in computer science
- The principle is to learn a very complex function with unit called “neurons” that are inspired by the electrical behavior of real neurons
- Deep learning algorithms are state-of-the-art in many applications.
- Did these algorithms perceive like humans?

CNN

- Convolutional layers
- Fully connected layers (dense)
- Pooling



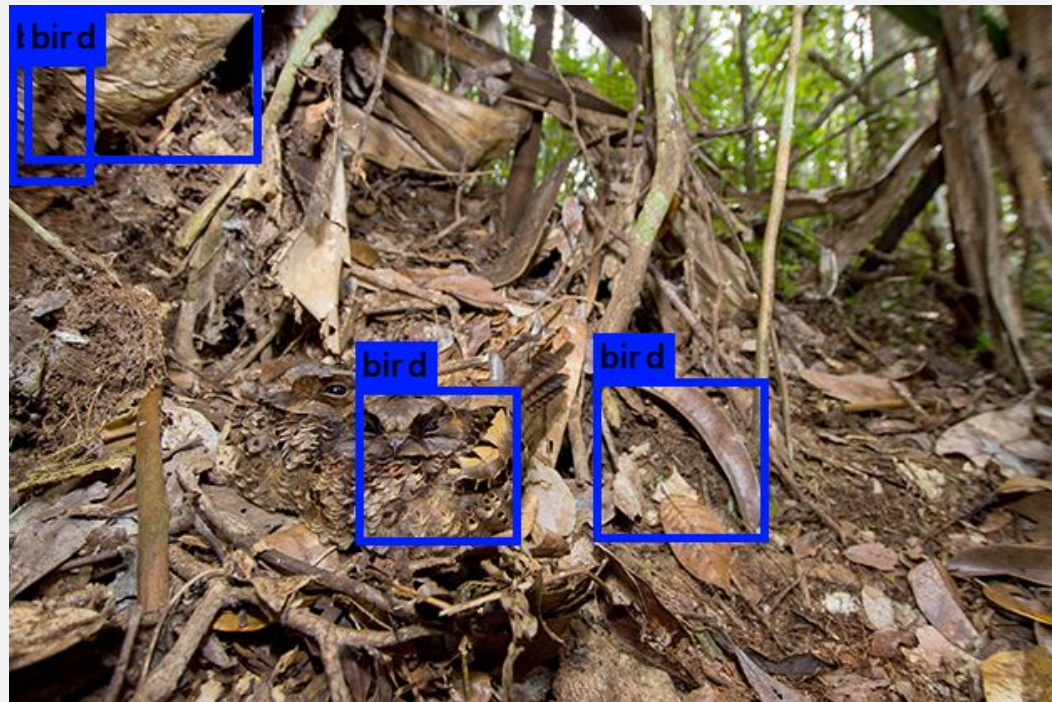
Example of perception with DNN

- What are you seeing?



Example of perception with DNN

- This is what the Deep Learning network is perceiving:



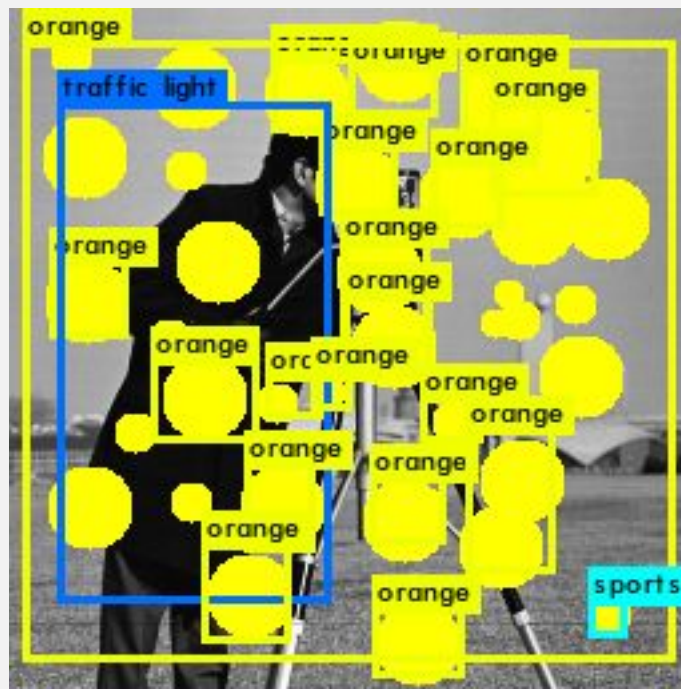
Is Deep Learning a kind of super-perception?

- What are you seeing?



Is Deep Learning a kind of super-perception?

- This is what the DNN is perceiving.



Is Deep Learning a kind of super-perception?

- Deep Neural Nets are not better to perceive compared to humans.
- In fact the strategy of DNN is different from what our brain is doing to understand our surrounding world

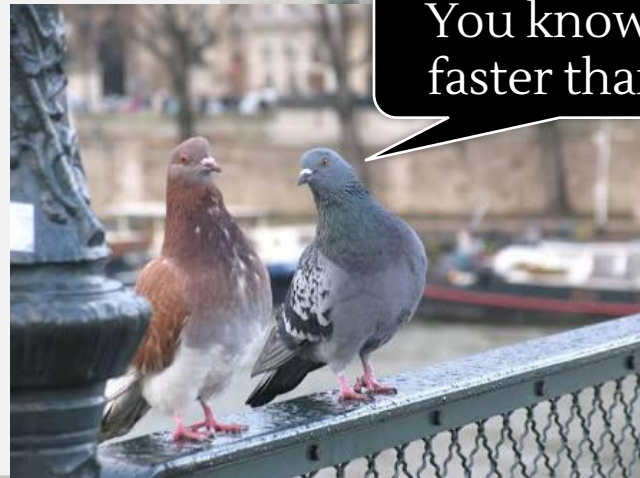
Two ways

- Now, two ways are opened: “mimicry” or “inspiration” from living animals.
- Do we need digital systems that are exactly like humans? There are some advantages because it could help for our cohabitation with robots.



Two ways

- However, another way is possible, inspired by aeronautic technology.
- After a first inspiration from birds, humans learn the most intimate principles of flight and succeeded to design tools beyond the capabilities of birds.



You know, I am faster than him

Thank you

- Questions?



French Concorde first commercial supersonic plane