KICK-OFF MEETING MINECO PID2020-118071GB-I00
IPs Valero & Jesus, septemb. 2021
TASKS (or Work Packages with links

GOAL 1: New Methods

VALERO 1.1 Layers to enforce equivariance/invariance

* Figure 2 (Equivariances)
* Se traduce en el diseño y prubea de capas de: DN, Multiscale, Multiorientation... (Figure 4)

VALERO 1.2 Statistically decoupled features, equivariance in generative models and dimensionality reduction

* The brain is computing statistics:
https://www.youtube.com/watch?v=sGkh1W5cbH4

* Statistics can be used for:
- texture synthesis: http://www.cns.nyu.edu/~lcv/texture/
- style transfer: (style transfer deep learning)

* Decopling statistics: Fig 6

* Manifold learning & Statistics:

https://colab.research.google.com/drive/1dCYGDiWnFv3c0V19Hvyga1PbNvYct2tO?usp=sharing

JESUS 1.3 Improving biological models through experiments driven by statistics
Psychophysics Noise and MAD
fMRI information transfer between voxel regions
https://isp.uv.es/docs/visual_neuro_tasks_MINECO_2021.pdf

GOAL 2: Extending classical models

JESUS 2.1 Bio-inspired architecture extension. Div. Norm. versus dynamical models and INRF
https://isp.uv.es/docs/visual_neuro_tasks_MINECO_2021.pdf

VALERO 2.2 Cost function modification.

* Style loss in perceptual models. (Fig 6)
http://www.cns.nyu.edu/pub/lcv/ding20-preprint.pdf

* Information theory as metric. (Fig. 8)
https://arxiv.org/pdf/2010.03807.pdf

JESUS 2.3 Noise in natural and artificial metworks. Estimated noise and Fisher information.
Artificial nets with natural noise induce human behavior?
https://isp.uv.es/docs/visual_neuro_tasks_MINECO_2021.pdf

VALERO 2.4 Model analysis

* Feature visualization
https://microscope.openai.com
InceptionV1 (mixed4c:447) is a car detector
which is built from a wheel detector (4b:373)
and a window detector (4b:237).

* Information quantification.

GOAL 3: Relations Brain-Statistics

JAVIER 3.1 Decoupled features

JESUS 3.2 Similarities and differences between artificial and natural NN
https://isp.uv.es/docs/visual_neuro_tasks_MINECO_2021.pdf
CSFs
Metrics
Visual illusions

JESUS 3.3 Information theory in the visual system
Information flow
Connectivity

GOAL 4: Relations with other fields

VICENT 4.1 Bio-inspired networks and control

- Control loops vs DN

VALERO 4.2 Bio-inspired networks and econometrics

- ARMA - conditional mean (linear part)
- GARCH - conditional variance (non-linear DN)

GOAL 5: Applications

VICENT 5.1 Control with human-robot interaction
- APP: Auto-driving
- Companies (Cecotec...)
- Hardware edge-devices (Coral TPU, Jetson Nano, FPGA, Intel...)

JAVIER 5.2 Image processing
Perceptual metrics (jesus-valero)
Image manipulation & synthesis

VALERO 5.3 Bio-inspired stock-market analysis

- APP: Use DN in stock market series prediction.