Visual and Multimodal Learning Systems for Human Behavior Understanding

UNIVERSITAT DE BARCELONA

Dr. Sergio Escalera

www.sergioescalera.com

sergio@maia.ub.es

University of Barcelona

UNIVERSITAT DE BARCELONA

- Universitat de Barcelona, established in 1450, is one of the top public universities in Barcelona, Spain. It is ranked #168 in QS Global World Rankings 2022.
- 16 faculties & 10 affiliated centres.
- 63K students, 5.2K teachers+researchers, 4.5K trainee researchers, 600 PhD thesis (2018).

University of Barcelona – Faculty of Mathematics and Informatics

- Informatics degree, Prof. Sergio Escalera head of Informatics
- Mathematics degree

- Master involvement (interuniversitary):
  - AI
  - Data Science
  - Computer Vision
  - Behavioral Data Science (in preparation)

  https://www.il3.ub.edu/master-behavioral-data-science

Computer Vision Center (CVC-UAB)

Only Center in Europe fully devoted to Computer Vision

- CVC is a legally independent non-profit institution founded in 1995, belonging to the Catalan CERCA network. Located in Bellaterra (Barcelona). Dedicated to research, technology transfer, training, and outreach.
- 38 senior researchers + 52 students (2019)
- 45 JCR indexed journals, 65 international conference papers, 12 thesis (2019).
- **HuPBA**, head Prof. Sergio Escalera, 1 of the 8 strategic research lines

Research fields	Application domains:
• Computer Vision • Machine Learning • Social Signal Processing • Affective Computing • Personality Computing	• eHealth and well-being • Security • Smart cities • Leisure
Research lines	**Main collaborators**

• Deep Learning
• Domain Adaptation
• Bias and fairness
• Explainability and interpretability
• Spatio-temporal modeling & video understanding
• Multi-modality, multi-view & multi-task learning
• Attention mechanisms
	• Medical researchers:
	  • Psychologists
	  • Psychiatrists
	  • Neurologists
	• National (UAB, UOC), and international universities (AAU, Berkeley, Boston)
	• Companies (Google, Microsoft, Disney, Amazon, NVIDIA, and Facebook)

12
YEARS

14+
MEMBERS

300+
TOTAL PUBLICATIONS

40+
COMPETITIVE PROJECTS

30+
TRANSFER ACTIVITIES

20+
INTERNATIONAL COMPETITIVE PROJECTS

- Research group at the **Computer Vision Center** and **Universitat de Barcelona**
- **Currently 14 researchers** associated from different institutions: UB, CVC, UAB, UOC, AAU

Sergio Escalera
Full profesor (UB / AAU / CVC)

Meysam Madadi
Post doc (CVC)
3D+ humans

Julio Jacques
Post doc (UOC)
Fairness

Albert Clapés
Post doc (AAU)
Video understanding

Cristina Palmero
Pre doc (UB)
Gaze, emotion, personality

Marc Oliu
Pre doc (UB)
Domain adaptation, video prediction

Javier Selva
Pre docUB
Video understanding

Hugo Bertiche
Pre doc
UB
3D+ humans

Sorina G. Smeureanu
Pre doc
UB
Transfer/synthesis emotion induction

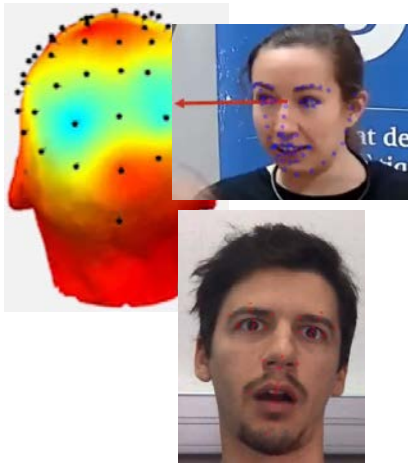
Mohammad Almasi
Pre doc
UB
Vision in sports

Rubén Ballester
Research assistant UB
Explainability/Interpretability

German Barquero
Pre doc
UB
Behavior Forecasting

Overview of current research lines in LAP

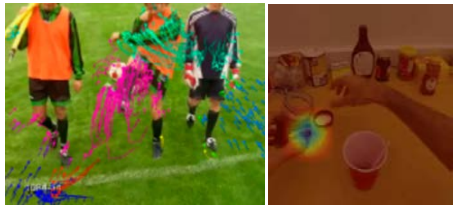
FACE ANALYSIS



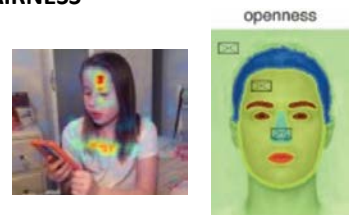
VISUAL (AND MULTIMODAL) MODELING OF HUMANS

3D (& 4D) POSE, SHAPE, TEXTURE (IN 3D AND FROM 2D)

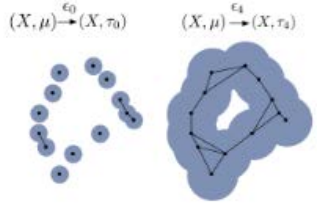
BEHAVIOR ANALYSIS



UNDERSTANDING AND EXPLAINING HUMAN BEHAVIOR (Affective & Personality Computing)
-INTERPRETABILITY & EXPLAINABILITY
-FAIRNESS



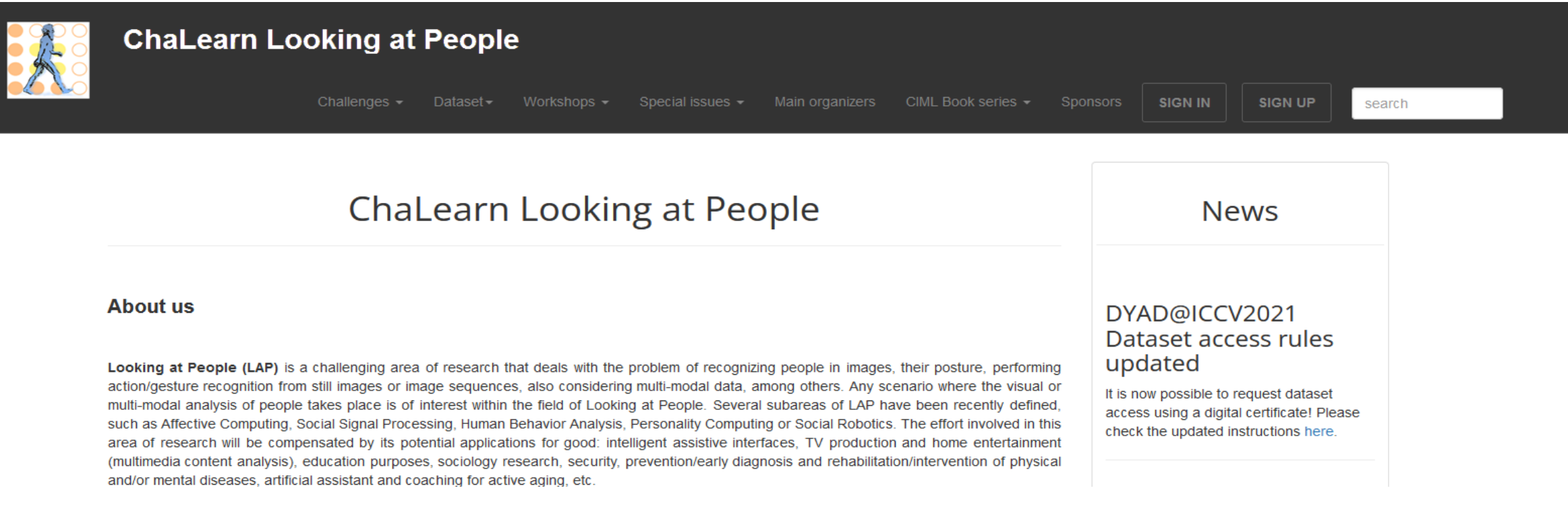
BIAS ANALYSIS VISUALIZATION



INTERPRETING AND EXPLAINING LEARNING

ChaLearn

- Non-profit organization. Berkeley. We organize challenges to stimulate research in this field. The web sites of past challenges remain open for post-challenge submission as ever-going benchmarks Promoting open data, educational materials, and challenge organization. Link with ChaLearn and Codalab initiatives.
- President: Isabelle Guyon, Université Paris-Saclay, France
- Vice-president: Sergio Escalera, University of Barcelona, Spain



ChaLearn Looking at People

Challenges ▾ Dataset ▾ Workshops ▾ Special issues ▾ Main organizers CIML Book series ▾ Sponsors SIGN IN SIGN UP search

- > 20 new datasets
- > 20 organized challenges at CVPR, ICCV, ECCV, NeurIPS, …
- > 20 organized workshops at CVPR, ICCV, ECCV, NeurIPS, …
- > 10 organized Special Issues to related workshop/challenge topics

Main sponsors

Microsoft Google amazon IAPR NVIDIA Disney Research facebook

The Springer Series on Challenges in Machine Learning

Series Editors: **Escalante**, Hugo Jair, **Guyon**, Isabelle, **Escalera**, Sergio

ISSN: 2520-131X

ABOUT THIS SERIES

The books in this innovative series collect papers written in the context of successful competitions in machine learning. They also include analyses of the challenges, tutorial material, dataset descriptions, and pointers to data and software. Together with the websites of the challenge competitions, they offer a complete teaching toolkit and a valuable resource for engineers and scientists.

~10 edited volumes up to date

CodaLab

Accelerating reproducible computational research.

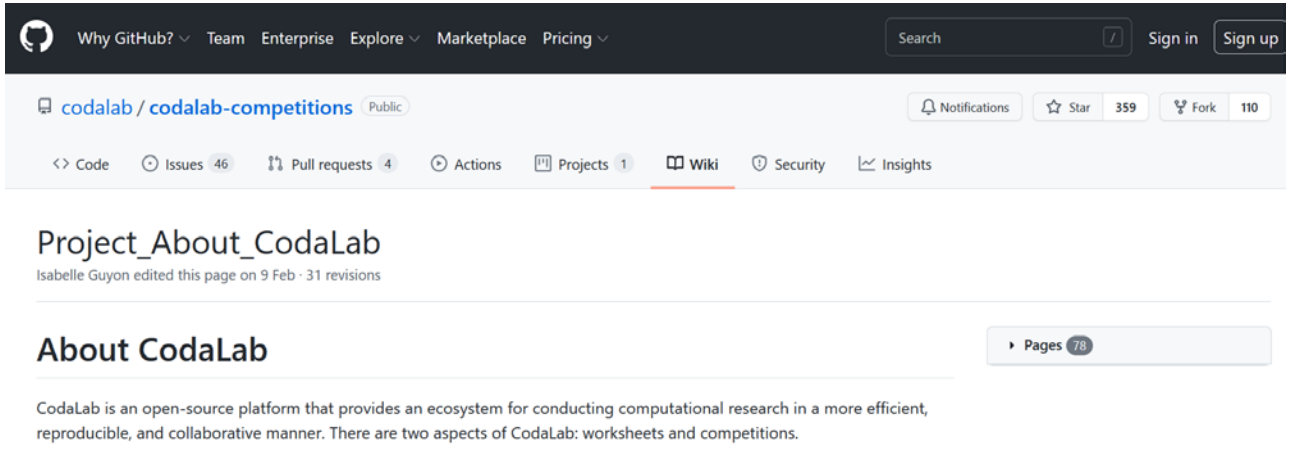
The CodaLab Team

Percy Liang is an assistant professor of Computer Science at Stanford University. His primary research areas are machine learning and natural language processing. He leads the development of CodaLab in close collaboration with Microsoft Research and the rest of the community.

Isabelle Guyon is full professor at UPSud University Paris-Saclay and president of ChaLearn a non-profit organization dedicated to running machine learning competitions. Her research interested include automatic machine learning, transfer learning, and causal discovery. Isabelle served as an advisor in the development of the CodaLab competition platform and pioneered the implementation of several challenges on Codalab.

Evelyne Viegas is a Director at Microsoft Research responsible for the outreach artificial intelligence program. She leads the CodaLab project working in collaboration with Isabelle Guyon, Percy Liang and the machine learning and artificial intelligence communities.

Sergio Escalera is adjunct professor at Universitat Oberta de Catalunya, Aalborg University, and Dalhousie University and a member of the Visual and Computational Learning consolidated research group of Catalonia and a member of the Computer Vision Center at UAB. He is series editor of The Springer Series on Challenges in Machine Learning. He is Editor-in-Chief of American Journal of Intelligent Systems and editorial board member of more than 5 international journals. He is vice-president of ChaLearn Challenges in Machine Learning, leading ChaLearn Looking at People events.



- One of the main preferred open source competition platforms by the community
- More than thousand organized competitions

Stanford University

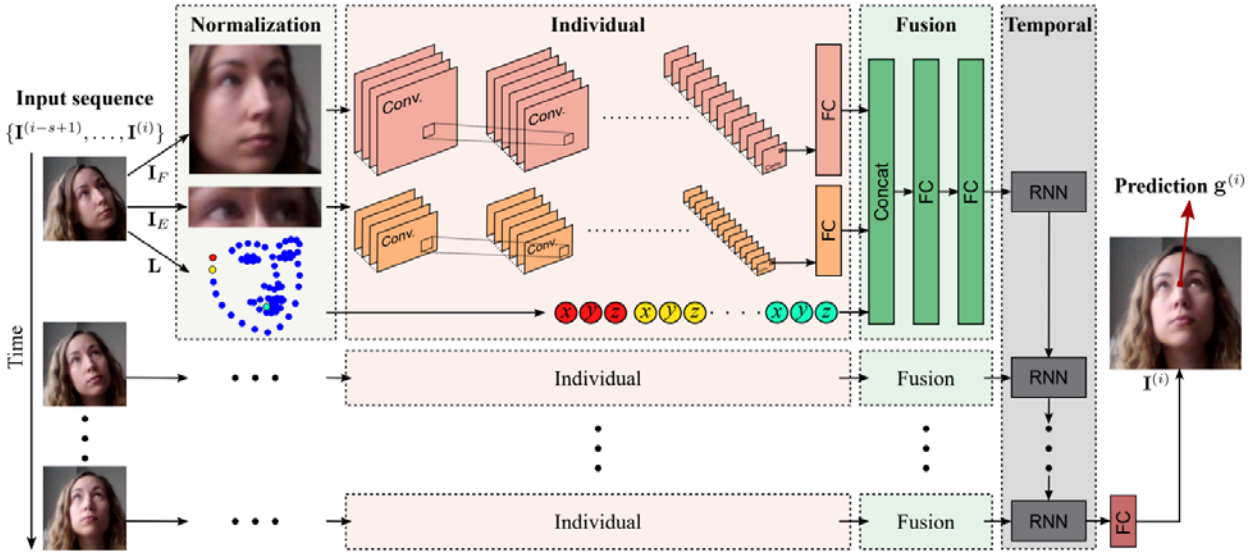
CHALEARN

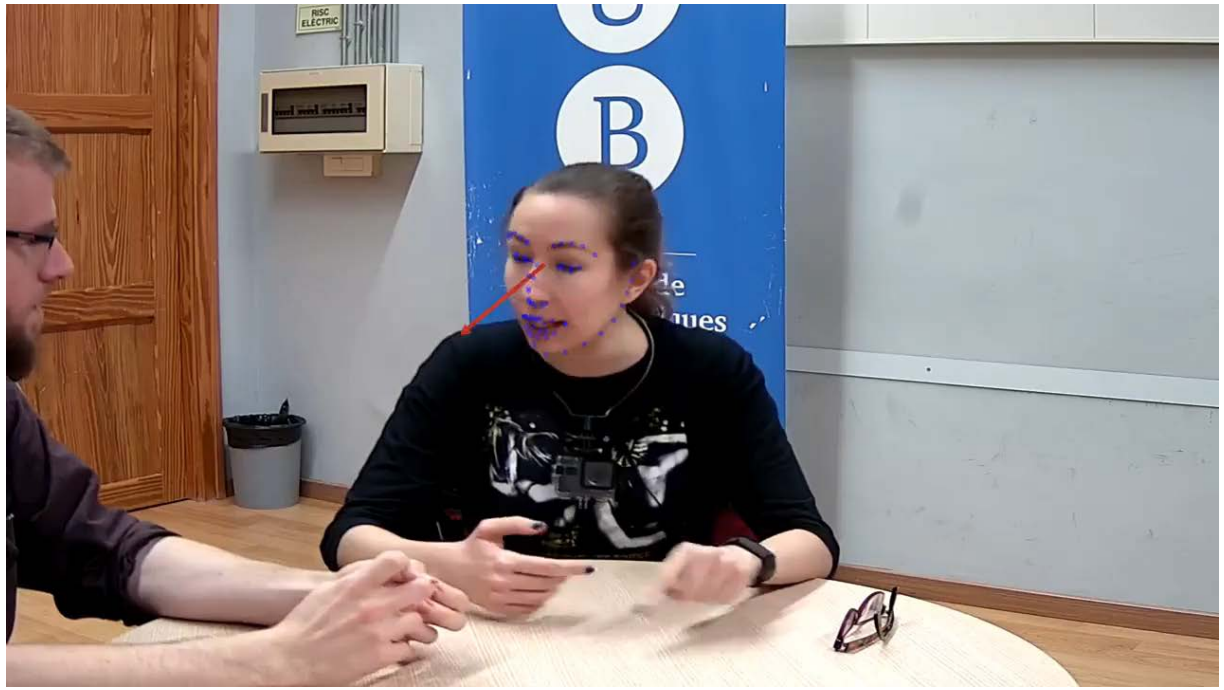
Microsoft

université PARIS-SACLAY

Face analysis

- Gaze
- Facial Action Units





Palmero et.al. BMVC 2018

Face analysis

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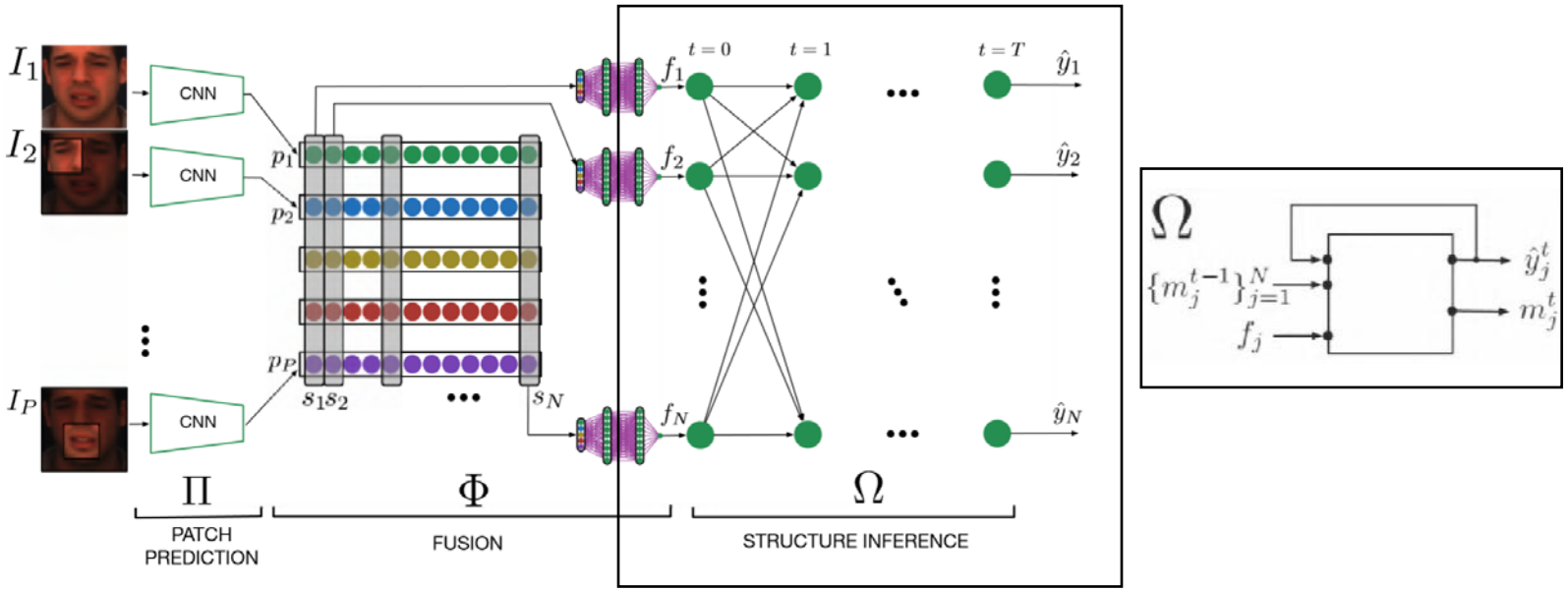
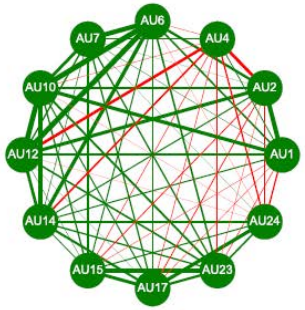
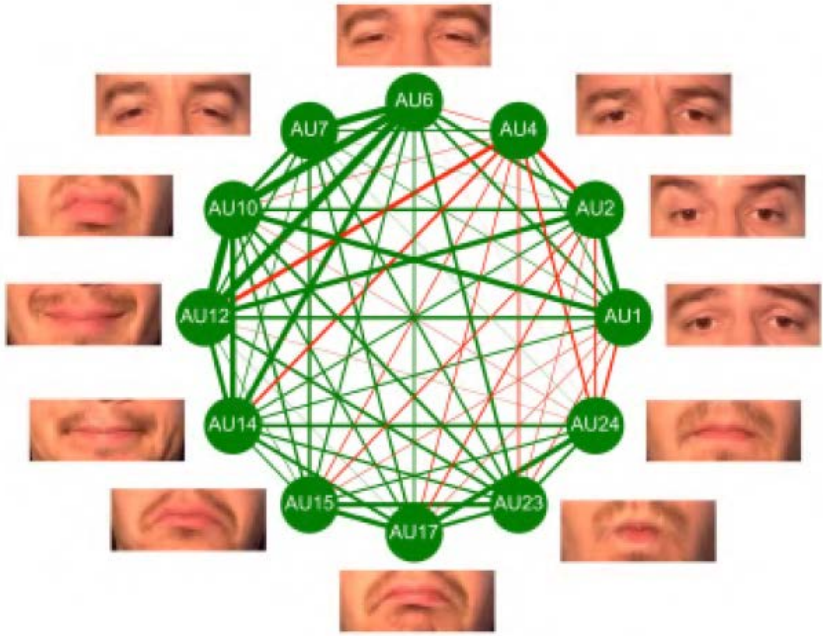


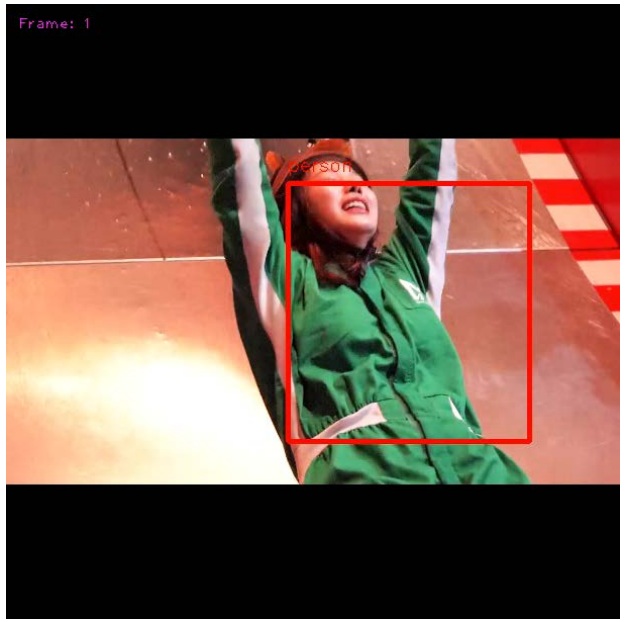


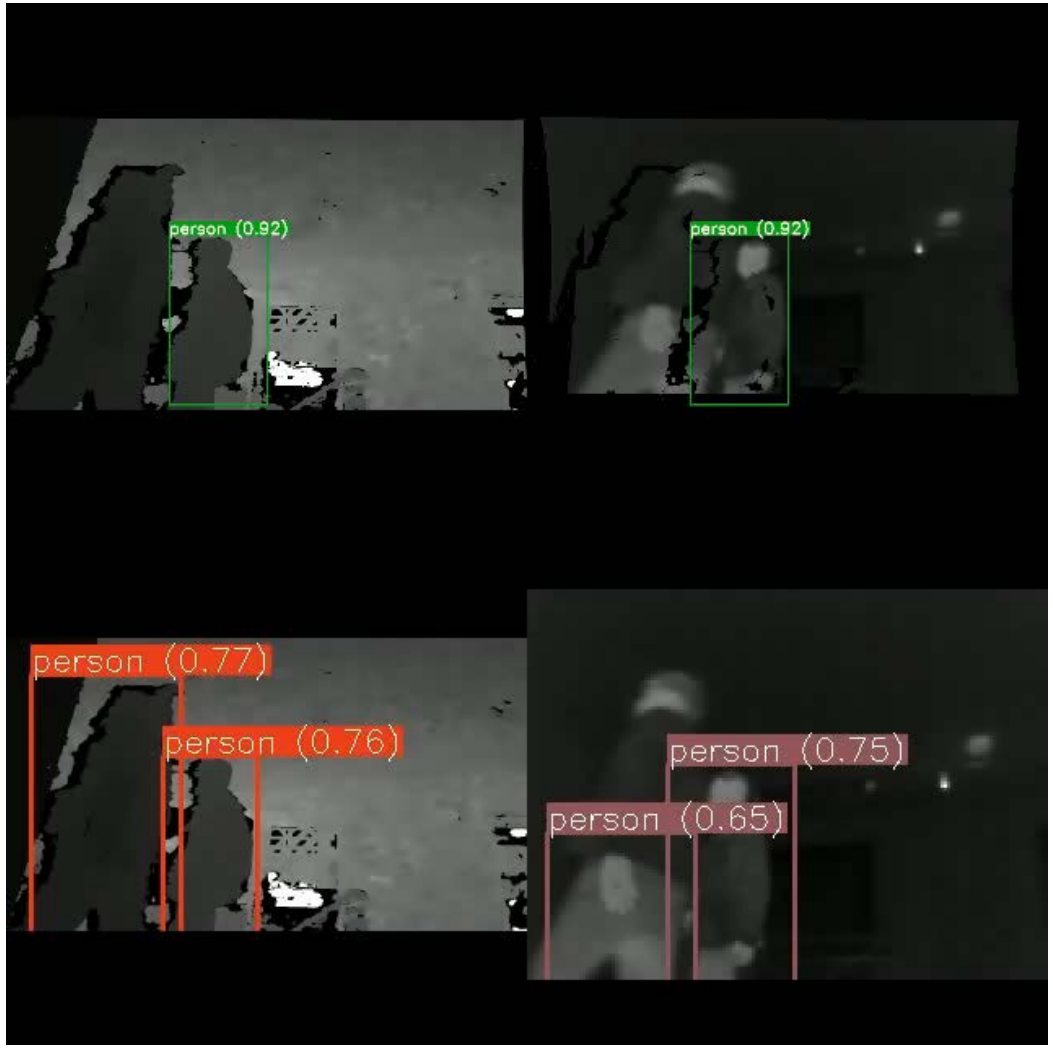


Corneanu et.al. ECCV 2018

Body Analysis

- Detection
- Posture and multimodal





Body Analysis

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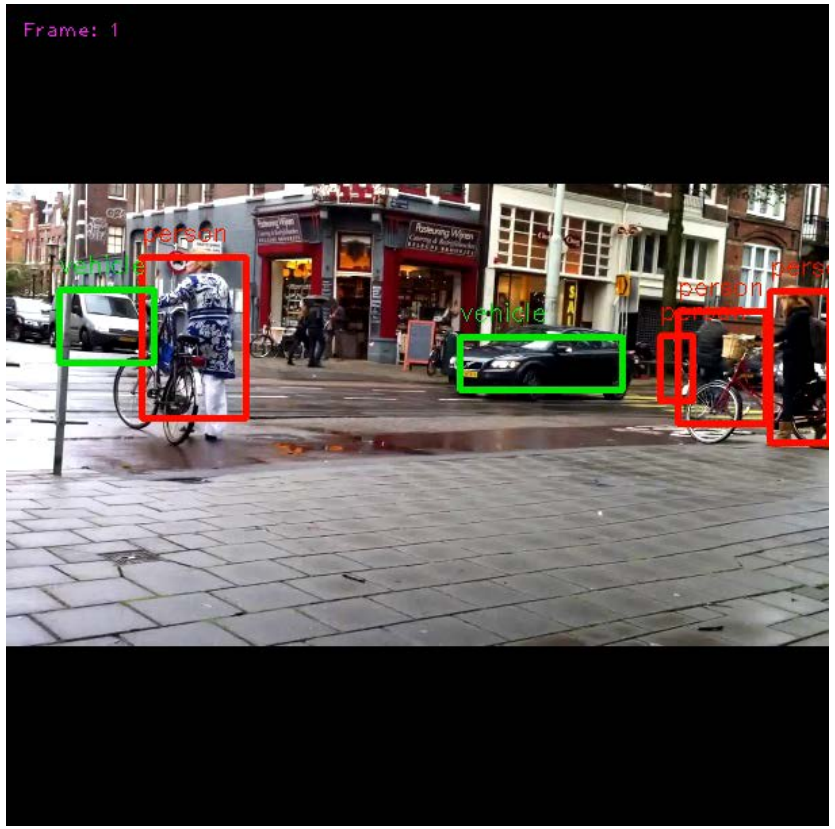

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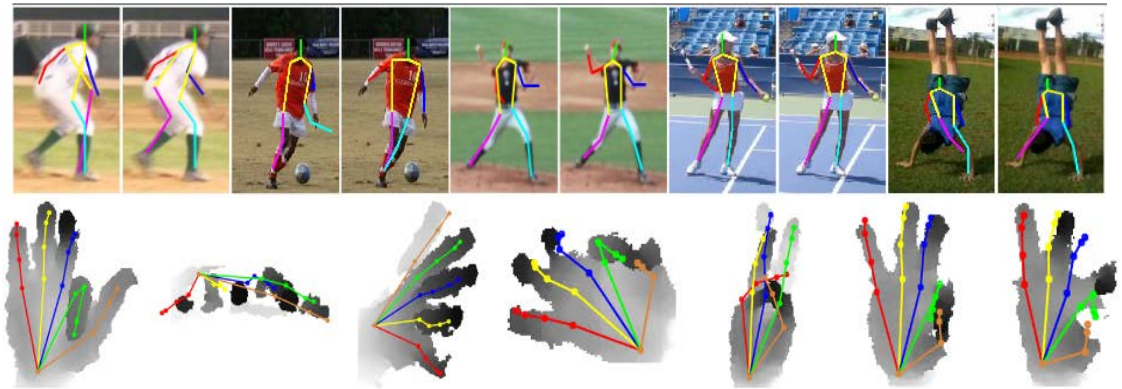
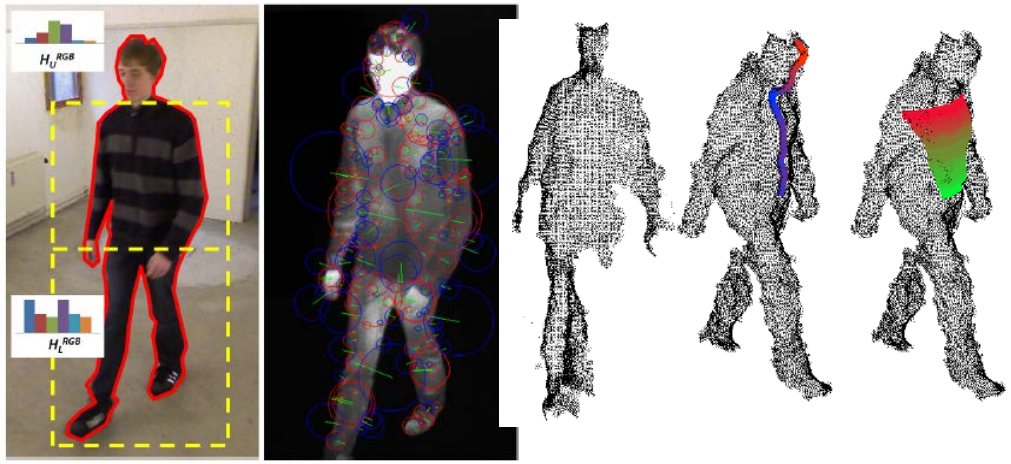
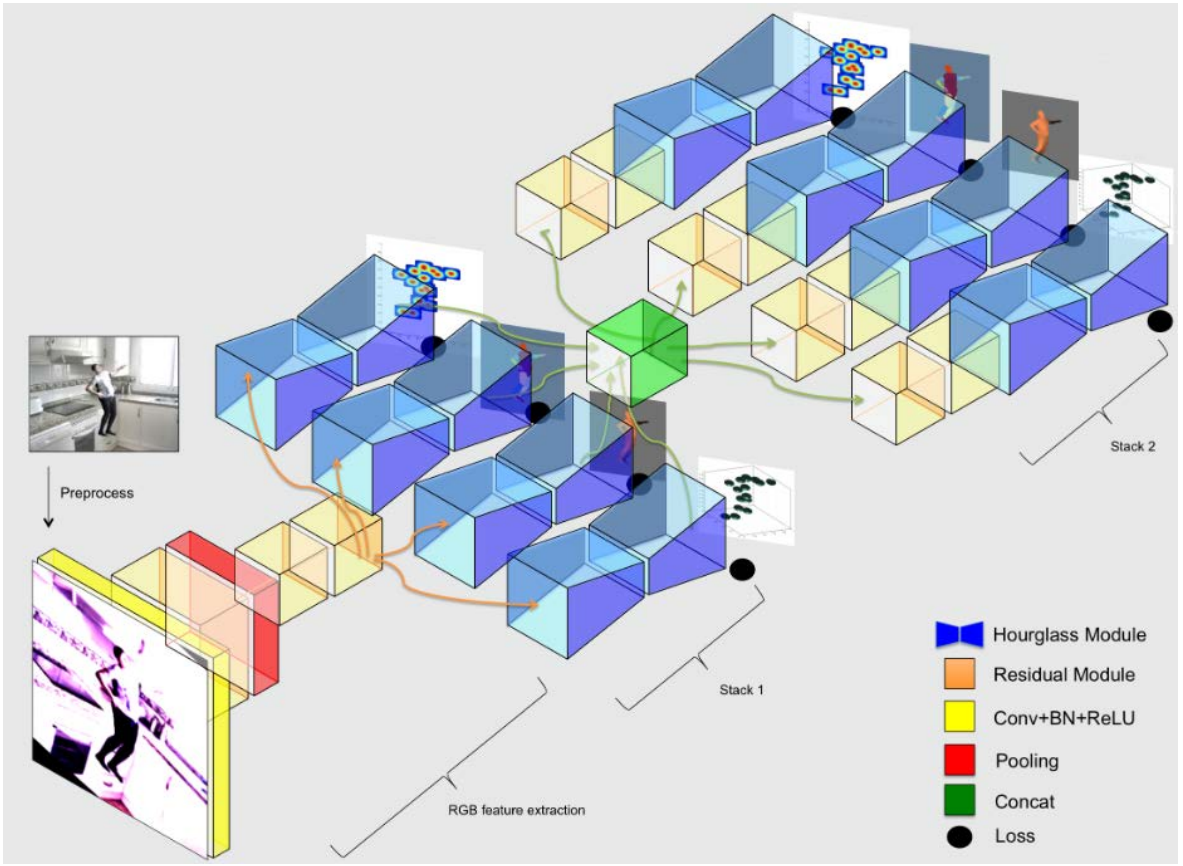




Sanchez et.al. FG 2019



Shanxin Yuan et.al. CVPR 2018

Body Analysis

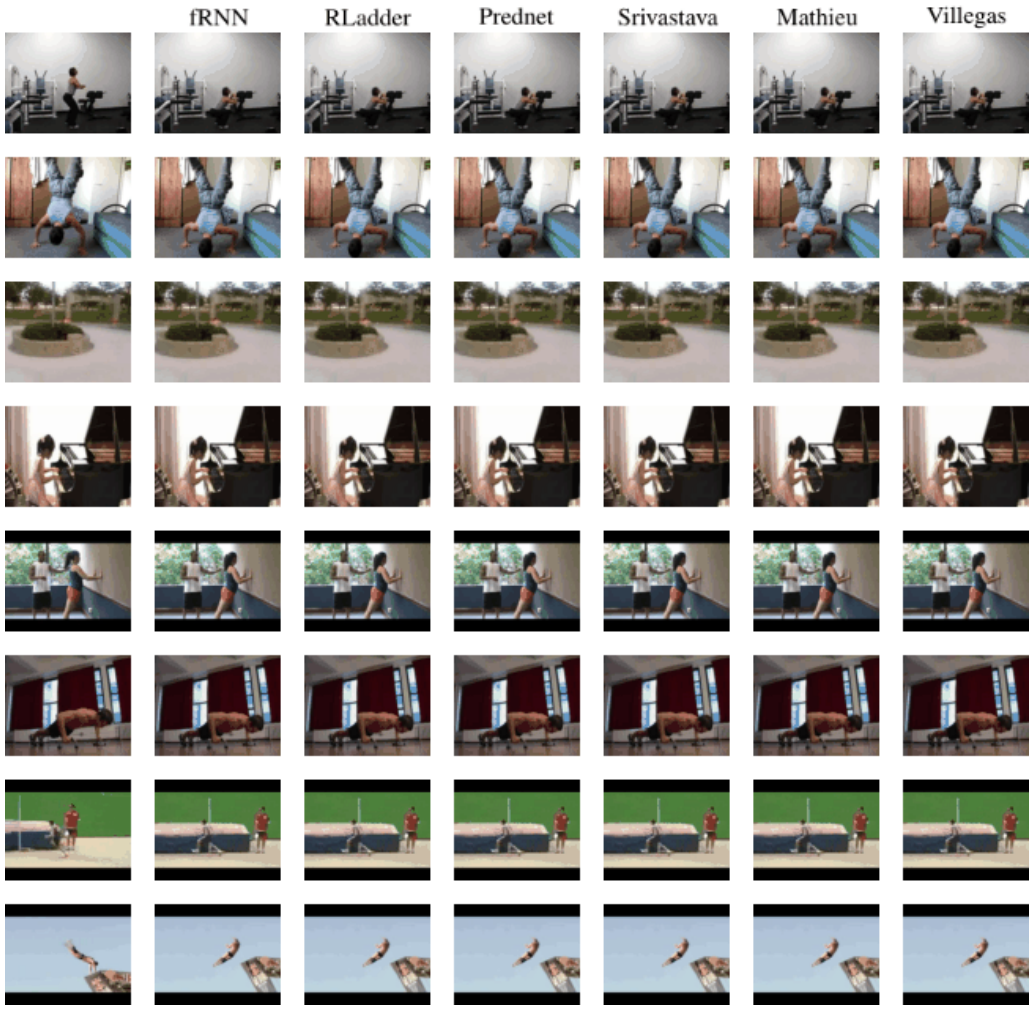
- Detection
- Posture and multimodal

SMPLR: Deep SMPL reverse for 3D human pose and shape recovery

Meysam Madadi, Hugo Bertiche and Sergio Escalera

Madadi et.al. PR 2020
Bertiche et.al. ICCV 2021, SIGGRAPH ASIA 2021

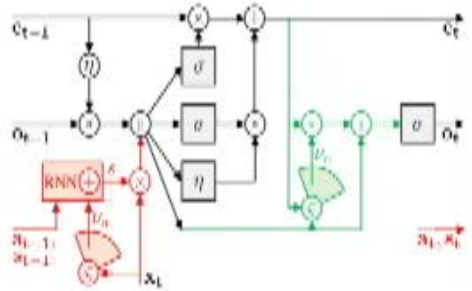
Behavior



Oliu et.al. ECCV 2018

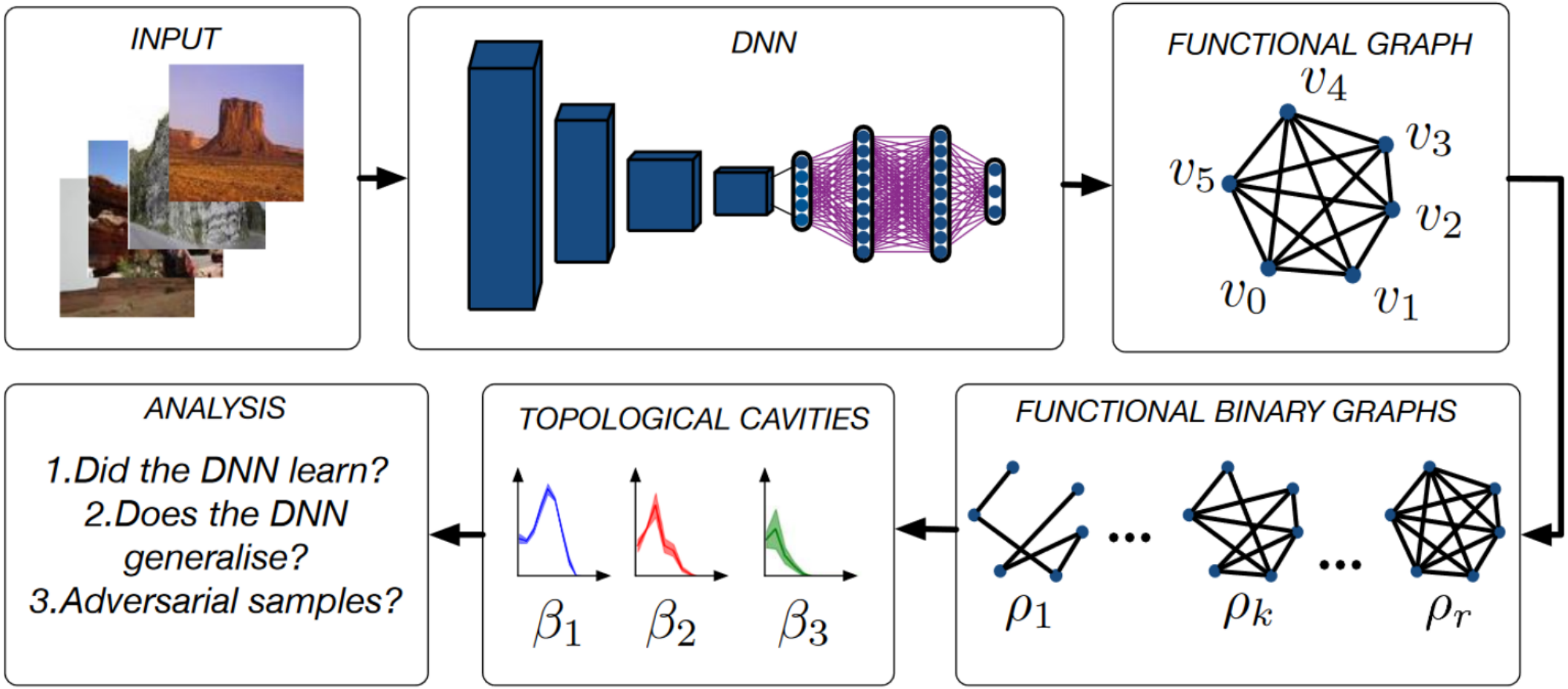
Long Short-Term Attention

State-of-the-art recognition performance



Sudhakaran et.al. CVPR 2019, CVPR 2020

Interpretability



Corneanu et.al. CVPR 2019, CVPR 2020

CVPR best paper award nominee

Real applications and transfer activity

- Adaptive **neuro-rehabilitation** (visual affective and attentive states)
- Monitoring in **schizophrenia** (visual facial expressions monitoring)
- Promoting **social activity for the elder** (multimodal audio-visual interactive social conversational agent, EMPATHIC H2020)
- Monitoring activities in **dementia** – promoting independent living (routine modelling, reminders, visual & IMUS)
- Monitoring people with **disabilities** for **risk events** (risk and anomaly behaviour modelling, RGB-D data modeling)
- …
- We are in the executive committee of the TECSAM Network for **Mental Health Technologies** of Catalonia

Current and future research interests

- **HBU**: affective, personality, dyadic and group interactions, social science aspects and multi-disciplinary research
- Promoting **explainability** for **transparency**
- **Bias** detection and mitigation for **fairness, context, personalization**
- **Multimodal** learning and with noise and asynchronous data
- **Self-supervised learning** to manage huge amount of data and reduce the need of annotated data
- **Synthetic data** to fill the gap in data distribution
- **Domain adaptation**
- **Uncertainty estimation and human in the loop**
- And **real applications, mainly in e-health and welfare**

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