

Quality of Life Support System for People with Intellectual Disability



Dr. Vasileios Mezaris

Research Director

Intelligent Digital Transformation Laboratory (IDT)

Information Technologies Institute / Centre for Research and Technology Hellas (ITI/CERTH)



DISPLAY



**beyond
GeoSense
standards**

QuaLiSID Objectives

The QuaLiSID project aims to develop a fully functional, user-friendly, interactive support system tailored to the needs of people with Intellectual Disability (ID)



HELLENIC REPUBLIC
MINISTRY OF
DEVELOPMENT AND INVESTMENTS
SPECIAL SECRETARIAT FOR
ERDF & CF PROGRAMMES
MANAGING AUTHORITY OF ERDF/ERDF

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ΕΡΑΝΕΚ 2014-2020
OPERATIONAL PROGRAMME
COMPETITIVENESS
ENTREPRENEURSHIP
INNOVATION

ΕΣΠΑ
2014-2020
Πρόγραμμα Συμπράξης
Εταιρειών - Επιχειρήσεων - Οργανισμών
Παράκληση Συμπράξεως
2014 - 2020



QuaLiSID—“Quality of Life Support System for People with Intellectual Disability” research project, which is co-financed by the European Union and Greek national funds through the Operational Program Competitiveness, Entrepreneurship and Innovation, under the call RESEARCH–CREATE–INNOVATE (project code: T2EDK-00306)

Three main system components / functionality sets:

- Web-based User Interface, for entertainment and education
- Detection of Emergency & Automated Assistance, using wearables/smartphone
- Other Smartphone Services

M. Papadogiorgaki, V. Mezaris, N. Grammalidis, K. Grigoriadis, E. Bei, G. Livanos, M. Zervakis, "Quality of Life Support System for People with Intellectual Disability", Proc. 13th ACM Int. Conf. on Pervasive Technologies Related to Assistive Environments (PETRA 2020), Corfu, Greece, June-July 2020.

[DOI:10.1145/3389189.3397971](https://doi.org/10.1145/3389189.3397971).

QuaLiSID Objectives

Web-based User Interface

- The integrated platform provides information, entertainment, creative activities and training content **recommendations**, according to the individual preferences, interests and skills of people with ID.
- Content access through a web-based user-friendly interface addressed for convenient use by people with ID, who have difficulties in efficiently handling IT systems.
- The detailed thematic categories have been formed according to the general preferences and interests of people with ID.
- The individual preferences in systems categories are stored in the user profile and dynamically updated according to the user's web-activity.

K. Apostolidis, V. Mezaris, M. Papadogiorgaki, E.S. Bei, G. Livanos, M.E. Zervakis, "Content and Other Resources Recommendations for Individuals with Intellectual Disability: A Review", Electronics, vol. 11, no. 21:3472, Oct. 2022. [DOI:10.3390/electronics11213472](https://doi.org/10.3390/electronics11213472).

QuaLiSID Objectives

Detection of Emergency & Automated Assistance

- Detection of health emergency situations, by monitoring critical biosignals (heart rate, oxygen saturation, body temperature) using wearable sensors, i.e. smartwatches.
- Detection of disorientation and wandering behavior by monitoring location data from smartphones' GPS.
- Automated system alerts and notifications towards the responsible care givers in case of emergency.
- “Call for help” functionality for emergency alerts, using the emergency button, integrated into smartphones.
- Automated system support through a smartphones' specialized voice menu of instructions in case of emergency.

QuaLiSID Objectives

Other Smartphone Services

- Phone communication (voice and video calls, text messages) through voice commands and speech recognition capabilities integrated into smartphones
- Entertainment functionalities through the dedicated “virtual assistant” integrated into smartphones.
- Automatic sending of daily reminders to the caregivers and relatives, regarding the medication of people with ID.

Web-based User Interface

Content Categories

- After login to the system the user is lead to the page of general content categories (information, entertainment, etc).
- Depending on the age-range, i.e. adults or children with ID, the graphical environment slightly varies, yet containing identical categories.
- Selection of a general category leads to the page of the related detailed content categories.
- The detailed categories have been initially marked in the user profile with individual preference degrees, namely, Low, Medium, or High.

QuaLiSID General & Detailed Categories

News	Entertainment	Education	Creative Activities	Interactive Games	Virtual Exploration
Timeliness – Weather Forecast	Music	Maths	Painting - Crafts	Number Games	Natural Landscapes
Politics	Movies	Physics – Astronomy	Pottery	Crossword Games	City Attractions
Celebrities	Dance	Internet – IT	Cooking – Pastry	Assembling – Puzzles	Art – Technology Exhibitions
Architecture – Technology	Theater	People – Society – Ecology – Environment	Gardening	Riddles – Quizzes	Museums – Temples – Archaeologies
Culture – Art	Paintings	Biology	Knitting	Adventure	
Sports	Countries – Cities	Chemistry	Technology Usage	Scientific Fantasy	
Environment	Nature – Landscapes – Archaeological Sites	Language – Writing – Reading	Gymnastic – Dance	Strategy	
Decoration – Fashion	Animals – Plants	History – Archeology – Culture	Musical Instruments	Sport Games	
Hygiene – Diet		Geography – Geology			
Foreign News		Vocational Guidance			
		Foreign Languages			
		Literature			
		Theater – Art History			
		Music Theory			

Web-based User Interface

Content Recommendation

- Selection of a detailed category leads to the page of recommended content suitable for people (adults and/or children) with ID.
- The listed titles correspond to web-items of multiple formats, including text, image, video and multimedia.
- The number of suggested items per category is associated to the individual degree of preference, i.e. the higher the preference the longer the list of the presented items.
- Update of User Profile Preferences:
 - The categories' degrees of preference are explicitly initialized by the user under the assistance of the responsible caregiver and stored in the user profile.
 - The preferences are dynamically updated by the user's online activity; this relieves people with ID from manually changing the individual degrees of preference.

Quality of Life Support System for People with Intellectual Disability

QuaLiSID

Links to individual web-pages
of QuaLiSID project-site

[About QualiSID](#)[QuaLiSID Partners](#)[Useful Links](#)[Contact Details](#)

LOGIN





NEWS



Welcome John!

ENTERTAINMENT



EDUCATION



CREATIVE ACTIVITIES



VIRTUAL EXPLORATION



GAMES



SEARCH



NEWS

TIMELINESS – WEATHER FORECAST



CULTURE – ART



POLITICS



ARCHITECTURE – TECHNOLOGY



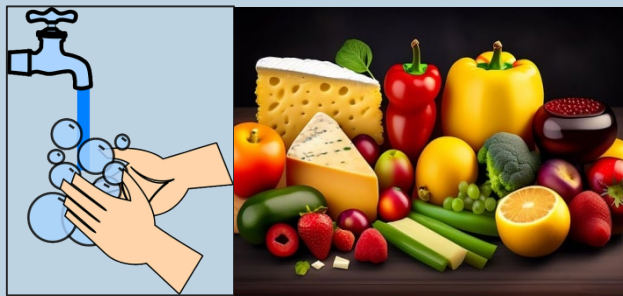
DECORATION – FASHION



SPORTS



HYGIENE – DIET



ENVIRONMENT



CELEBRITIES



WORLD NEWS



Selection

Welcome Alex!

ENTERTAINMENT



NEWS



EDUCATION



CREATIVE ACTIVITIES



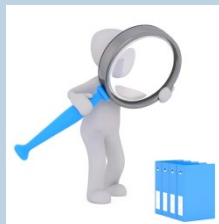
GAMES



VIRTUAL EXPLORATION



SEARCH



keyword



ENTERTAINMENT

High Preference

Low Preference

ANIMALS – PLANTS



PAINTINGS



COUNTRIES – CITIES



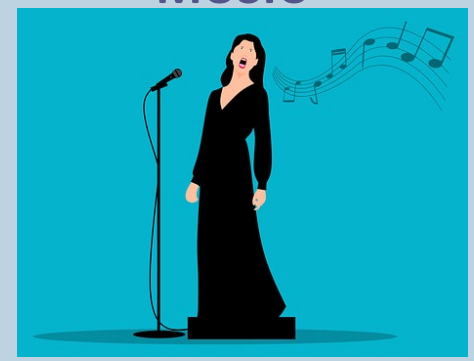
NATURE – LANDSCAPES – ARCHAEOLOGICAL SITES



THEATER



MUSIC



DANCE



MOVIES

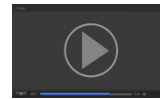




Articles



Pictures



Videos



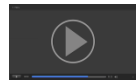
Multimedia



[Lion | Characteristics, Habitat & Facts | Britannica](#)



[Images of Wild Animals - Pixabay](#)



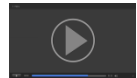
[Best Wild Animal Chases | BBC Earth - YouTube](#)



[Cat - Wikipedia](#)



[Cat Pictures & Images - Pixabay](#)



[Underwater World 4K - YouTube](#)



[Images of Colorful Flowers - Pixabay](#)



[Orchid | Britannica](#)



[Images of Herbs- Pixabay](#)



[Images of Fruit Trees](#)

Sort by Priority

Sort by Type

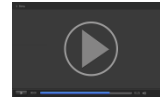




Articles



Pictures



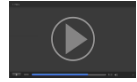
Videos



Multimedia



[Domestic cat - National Geographic](#)



[World's smallest cat - BBC - YouTube](#)



[Videos of funny cats and kittens](#)



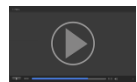
[Male African Lion \(Panthera leo\) lying](#)



[Wildlife - Wikipedia](#)



[Dolphins Facts - National Geographic](#)



[Swans! Swan Facts for Kids - YouTube](#)

After constant interest in a few items per day about wild animals and cats, the category is downgraded to Medium (from High) preference, resulting to the recommendation of fewer items

Sort by Priority

Sort by Type

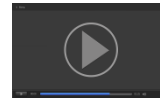




Articles



Pictures



Videos



Multimedia



[Pablo Picasso - Wikipedia](#)



[The Starry Night - Vincent van Gogh - Wikiart](#)



[Swans Reflecting Elephants - Salvador Dali - Wikiart](#)



[Top 10 Impressionist Paintings](#)

Sort by Priority

Sort by Type





Articles



Pictures



Videos



Multimedia



[Vincent van Gogh - Wikipedia](#)



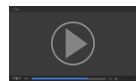
[Salvador Dali - Wikipedia](#)



[Guernica - Pablo Picasso - Wikiart](#)



[Vincent van Gogh's Paintings and Life](#)



[50 Most Famous Dali Paintings](#)



[Claude Monet - 1367 artworks – painting - Wikiart](#)



[Wassily Kandinsky - 229 artworks - painting - Wikiart](#)

After constant interest in all the items per day, the category is upgraded to Medium (from Low) preference, resulting to the recommendation of more items

Sort by Priority

Sort by Type





Articles

[Vincent van Gogh...](#)
[Salvador Dali...](#)

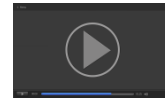


Pictures

[Guernica - Pablo Picasso...](#)

[Claude Monet - 1367 artworks...](#)

[Wassily Kandinsky - 229 artworks...](#)



Videos

[50 Most Famous Dali Paintings](#)



Multimedia

[Vincent van Gogh's Paintings and Life](#)

Sort by Priority

Sort by Type



Visual information analysis: in QuaLiSID and beyond – a more general overview of some relevant technologies of CERTH/ITI/IDT

- General goal:
 - Automatically annotate visual media with metadata
 - Make visual media searchable and findable
 - Support content recommendation, retrieval, easy inspection of relevant visual media to extract useful insights
- We look into three classes of visual information analysis techniques for search
 - Video event recognition (and explanation)
 - Free-text video search
 - Explainable deep learning
- Some of these techniques were developed or co-developed in QuaLiSID, others were developed in other projects (incl. H2020 CRiTERIA, H2020 AI4Media)
- Such techniques are not only relevant for the analysis and retrieval of generic content, but could also be extended to domain-specific content, such as medical data



Video event recognition

- Goal: in-depth understanding of visual information; recognize real-world events depicted in videos
- Intended use: search for and find the videos showing events of interest
- General approach (ViGAT, Gated-ViGAT):
 - Sample the video to select frames; **detect a multitude of object regions** within each frame
 - Represent both objects and entire frames in a high-dimensional feature space using a pre-trained Transformer network
 - Use a learning architecture based on Graph Attention blocks (“ViGAT head”) to learn **to recognize the target events**, and also to **provide explanations for these recognition decisions**
 - Improve the scalability of the above approach by using part of the explanation signal to guide the network to process in depth (extract & represent objects) only the few frames that are most informative and needed for making a confident event recognition decision for a given video

N. Gkalelis, D. Daskalakis, V. Mezaris, "ViGAT: Bottom-up event recognition and explanation in video using factorized graph attention network", IEEE Access, vol. 10, pp. 108797-108816, 2022. [DOI:10.1109/ACCESS.2022.3213652](https://doi.org/10.1109/ACCESS.2022.3213652).

N. Gkalelis, D. Daskalakis, V. Mezaris, "Gated-ViGAT: Efficient bottom-up event recognition and explanation using a new frame selection policy and gating mechanism", Proc. IEEE Int. Symposium on Multimedia (ISM), Naples, Italy, pp. 113-120, Dec. 2022. [DOI:10.1109/ISM55400.2022.00024](https://doi.org/10.1109/ISM55400.2022.00024).

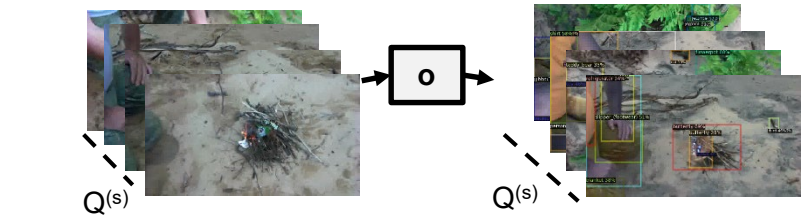
Video event recognition

- Gated-ViGAT architecture

Input: just the actual video frames; no other annotations (even if available) are processed



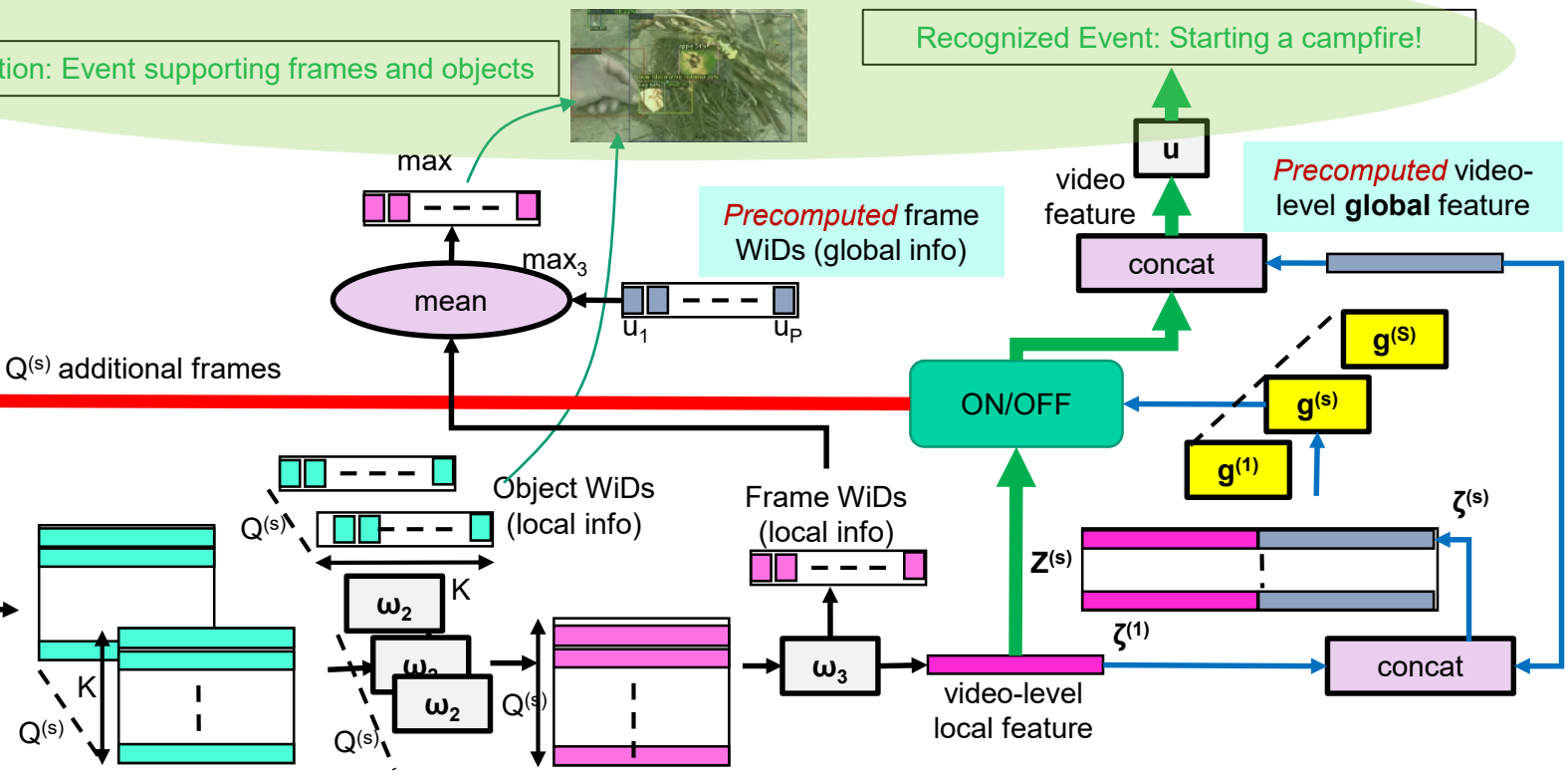
Frame selection policy



Output: the recognized event, plus an explanation for the recognition decision

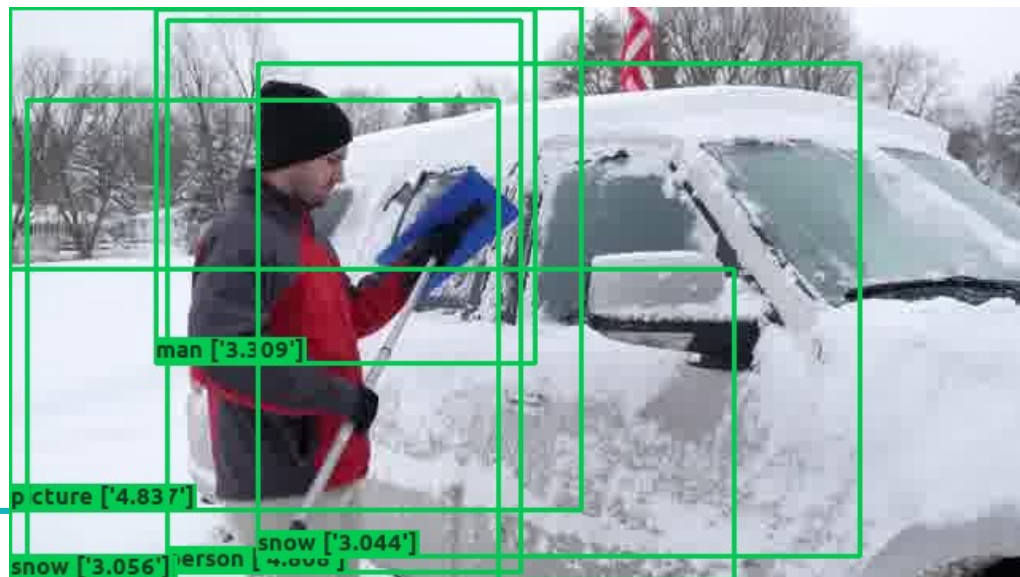
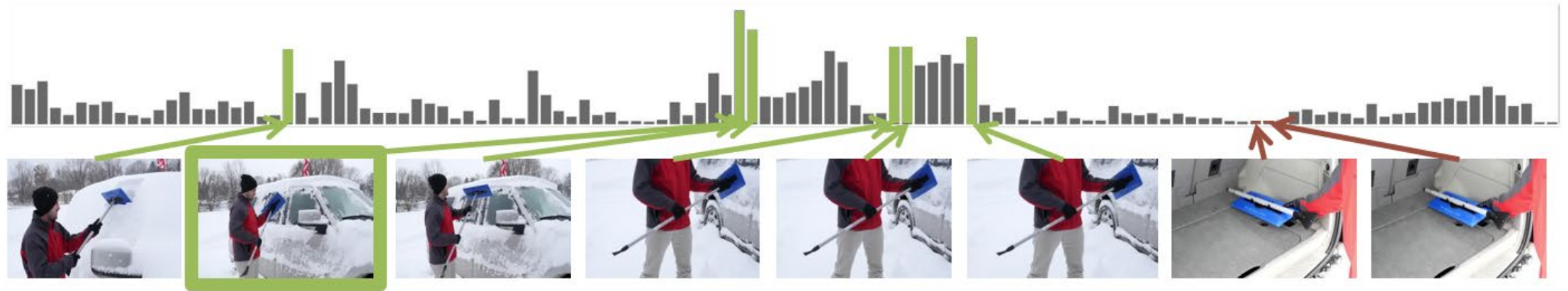
Explanation: Event supporting frames and objects

Recognized Event: Starting a campfire!



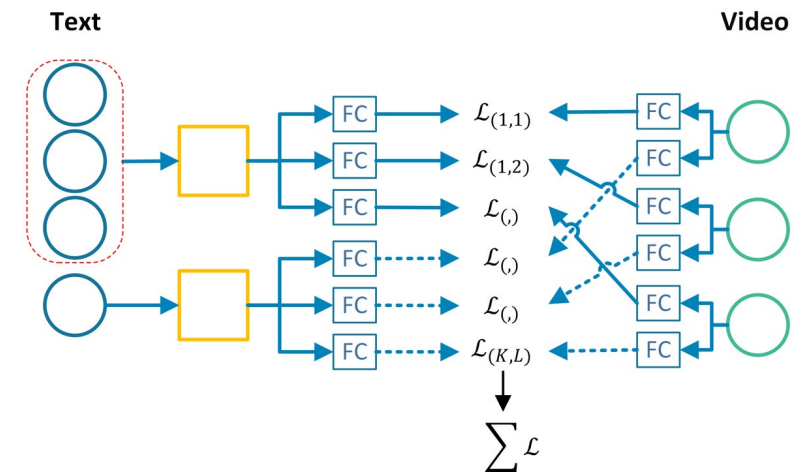
Video event recognition

- Example of “Removing ice from car” video, and explanations



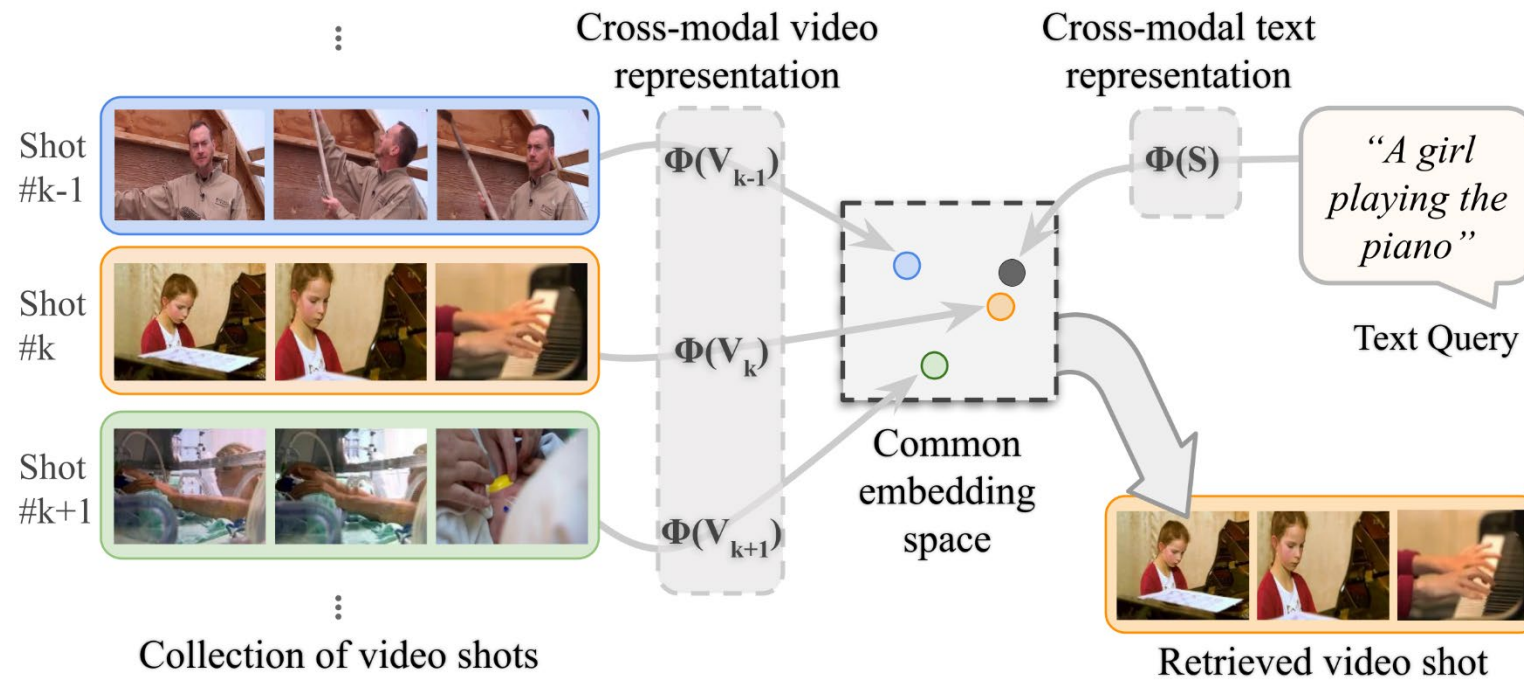
Free-text video search

- Goal: search for and find videos, even for activities / events that were not anticipated to be of interest
- Intended use: enter a free-text query that describes in natural language what you are looking for; find the relevant videos
- General approach (TxV):
 - Train on large corpora of video+caption pairs
 - Elegantly combine multiple representations (extracted using pre-trained networks) for both the visual and the textual modality
 - Use them as a stepping stone for learning to represent both videos and captions in a joint feature space
 - After training
 - Apply the trained network on the videos once, to extract their representation in the joint feature space - **again, input: just the actual video frames; no text / other annotations**
 - When a free text query is issued, apply the trained network on it and match the extracted query representation to the video representations, to find the relevant videos



D. Galanopoulos, V. Mezaris, "Are All Combinations Equal? Combining Textual and Visual Features with Multiple Space Learning for Text-Based Video Retrieval", Proc. ECCV 2022 Workshops, Springer LNCS vol. 13804, pp. 627–643, Oct. 2022. [DOI:10.1007/978-3-031-25069-9_40](https://doi.org/10.1007/978-3-031-25069-9_40)

Free-text video search



Free-text video search

- Example results for query: "a DJ playing music"



Free-text video search

- Example results for query: “a group of people kayaking”

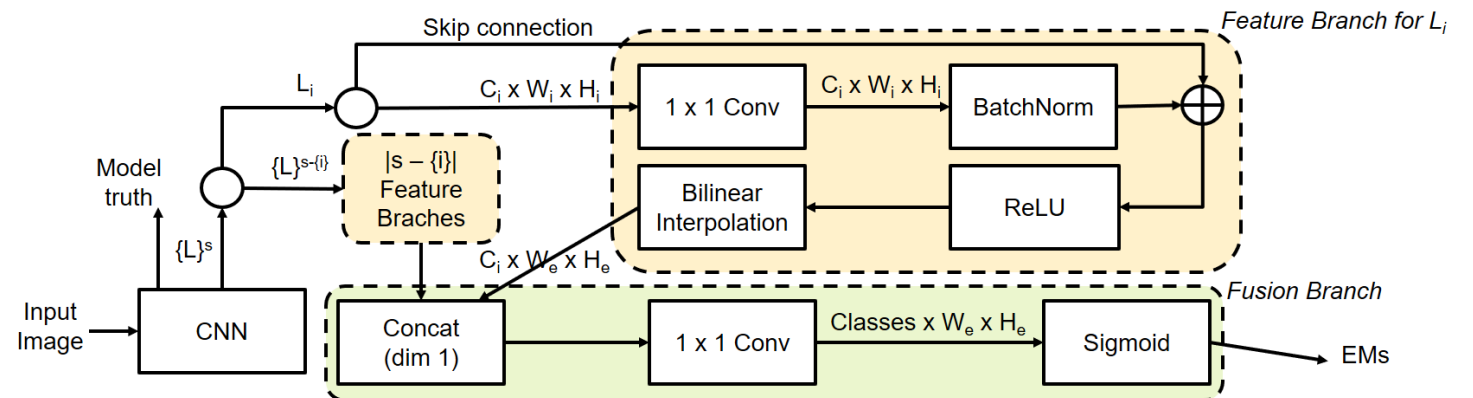


Explainable deep learning

- Goal: extract explanations for the decisions of image/video classifiers
- Intended use: primarily by data scientists; detect biases and other deficiencies in the classifiers
- General approach (TAME):
 - Introduce an attention-like mechanism in the backbone deep network that we want to endow with explainability characteristics
 - Train this attention mechanism to explain the decisions of the backbone deep network
 - After training, for each decision of the image classifier **efficiently produce an explanation map**, showing us where in the image the classifiers focused in order to make its decision

M. Ntroukas, N. Gkalelis, V. Mezaris, "TAME: Attention Mechanism Based Feature Fusion for Generating Explanation Maps of Convolutional Neural Networks", Proc. IEEE Int. Symposium on Multimedia (ISM), Naples, Italy, pp. 58-65, Dec. 2022. [DOI:10.1109/ISM55400.2022.00014](https://doi.org/10.1109/ISM55400.2022.00014).

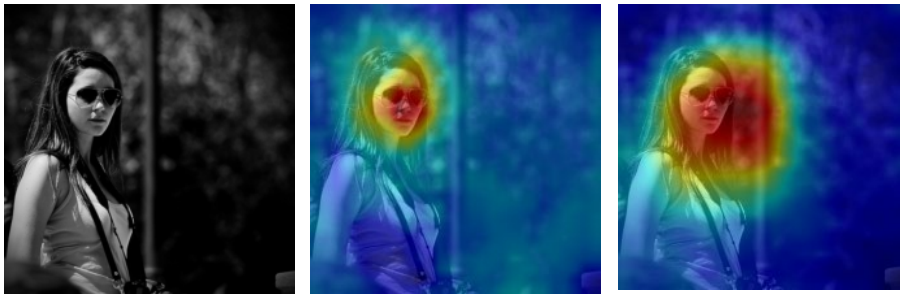
I. Gkartzonika, N. Gkalelis, V. Mezaris, "Learning Visual Explanations for DCNN-Based Image Classifiers Using an Attention Mechanism", Proc. ECCV 2022 Workshop on Vision with Biased or Scarce Data (VBSD), Springer LNCS vol. 13808, pp. 396-411, Oct. 2022. [DOI:10.1007/978-3-031-25085-9_23](https://doi.org/10.1007/978-3-031-25085-9_23).



Explainable deep learning

- Misclassification due to possibly learning another broader / related class (“sunglasses” vs “face wearing sunglasses”)

Correct classification examples:



sunglass



ground truth & predicted (vgg16)



ground truth & predicted (r50)

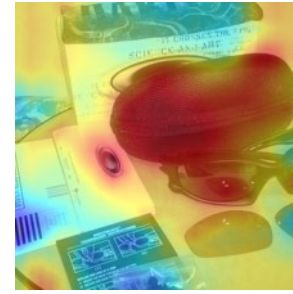
Erroneous classification examples:



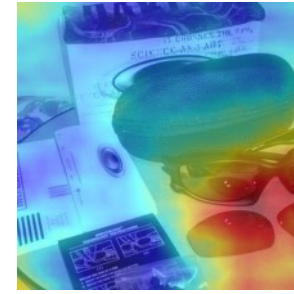
sunglass



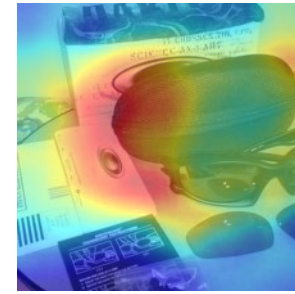
ground truth (vgg16)



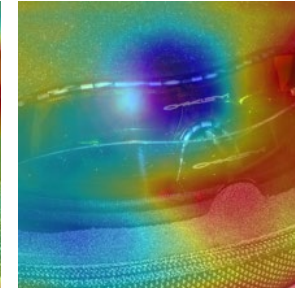
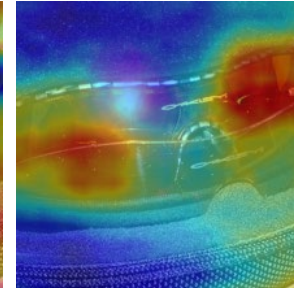
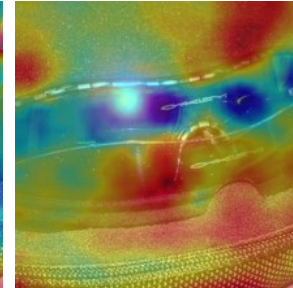
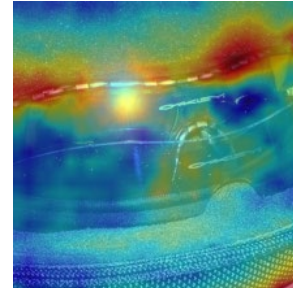
predicted (vgg16):
loudspeaker,
loafer



ground truth (r50)

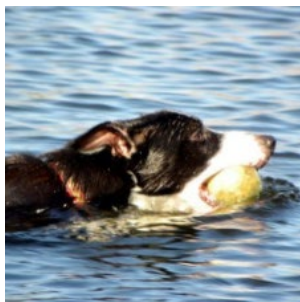


predicted (r50):
lens cap, crash
helmet

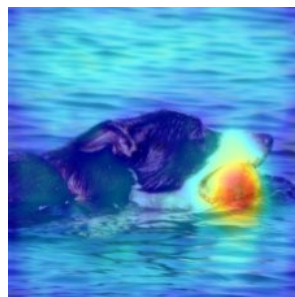


Explainable deep learning

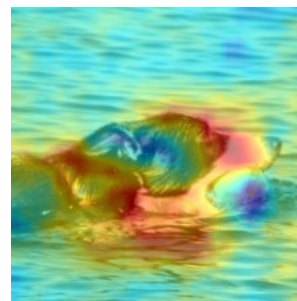
- “Misclassification” due to the presence of two different classes in the image



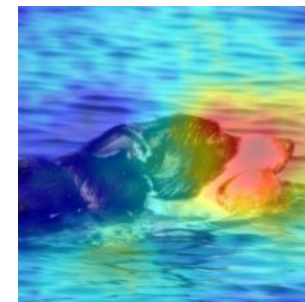
tennis ball



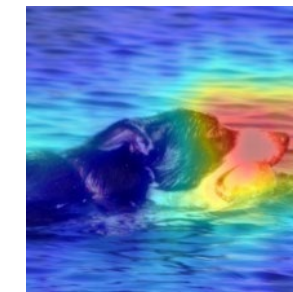
ground truth (vgg16)



predicted (vgg16):
English springer



ground truth (r50)



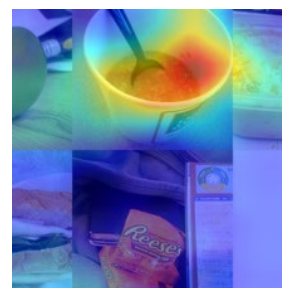
predicted (r50):
Border collie



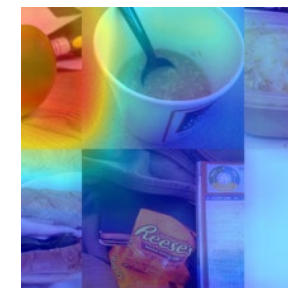
Granny Smith



ground truth (vgg16)



predicted (vgg16):
soup bowl



ground truth (r50)

predicted (r50) =
ground truth

Thank you!

Contact:

Dr. Vasileios Mezaris

Information Technologies Institute

Centre for Research and Technology Hellas

6th Km. Charilaou-Thermi Road

P.O. Box 60361, 57001 Thermi-Thessaloniki, Greece

Tel: +30 2311 257770

email: bmezaris@iti.gr

web: <http://www.iti.gr/~bmezaris>; <http://idt.iti.gr>