ITI-CERTH participation in TRECVID 2020

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Ad-hoc Video Search

Approach:

- Attention-based [1] dual-encoding neural network [2]
- The network encodes video-caption pairs into a common feature subspace
- Attention mechanisms are utilized for efficient textual and visual representation
- Two similar modules, trained in parallel:
  - The visual content
  - The natural language textual content
- Multi-level encoding for both modules
  - Mean pooling
  - Attention-based bi-GRU
  - bi-GRU-CNN
- Improved marginal ranking loss

Setup:

- Training datasets:
  - **TGIF** contains approximately 100k short animated GIFs and one description per each
  - **MSR-VTT** consisting of 10k short video clips, and 20 descriptions for every clip
- Evaluation dataset:
  - **V3C1** consisting of 7,475 videos and 1,082,659 video shots
- Video keyframe representation
  - Pre-trained ResNet-152 trained on the ImageNet-11k dataset
- Textual embeddings
  - Word2Vec trained on the English tags of 30K Flickr images
  - BERT trained on Wikipedia

Submission:

- AVS 2020 main task, evaluation on 20 textual queries
- AVS progress subtask, evaluation on 10 textual queries
- Mean Extended Inferred Average Precision (**MXinfAP**)

Run:

- One run for the main task and one run for the progress subtask
- Each run combines multiple training configurations in a late fusion scheme

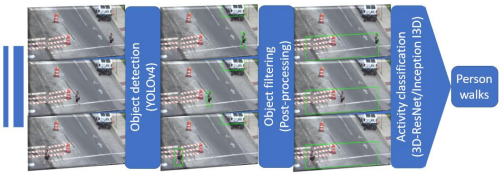
Results:

Task	Main	Progress
MXinfAP	0.202	0.159

Activities in Extended Video

Approach:

- Two-step approach:
  - Detection of objects in order to extract the **Extended Activity Bounding Boxes** (EABBox) using YOLOv4
  - Classification of each EABBox using 3D-CNNs, **3D-ResNet** and **Inception I3D,** in order to recognize the activities



Setup:

- **ActEV** contains 64, 54 and 246 videos for train, validate and evaluate sub-sets, respectively
- **Train** and **validate** activity classifier using 4311 and 3521 activities extracted from the corresponding sub-sets in order to assign an activity label to each EABBox
- Two post-processing steps were implemented to investigate four different system setups
  - **Post-processing 1** (Ps1): Examine the effect of merging overlapped EABBoxes
  - **Post-processing 2** (Ps2): Examine the immobility of objects at short intervals of time and discard EABBox with duration less than 20 frames

Submission:

- Four systems were evaluated:
  - **CERTH-ITI-I3D_base:** Ps1, I3D
  - **CERTH-ITI-YRW16:** Ps1, 3D-ResNet-50, weighted cross-entropy loss
  - **CERTH-ITI-YR16:** Ps1, CERTH-ITI-YRW16, considering activities more than 20 frames
  - **CERTH-ITI-P:** Ps2, CERTH-ITI-YR16

Results:

System Name	PARTIAL AUDC
CERTH-ITI-I3D_base	0.93125
CERTH-ITI-YRW16	0.88530
CERTH-ITI-YR16	0.88511
CERTH-ITI-P	**0.86576**

Disaster Scene Description and Indexing

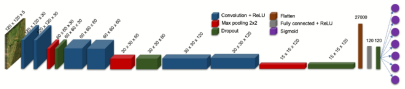
Identification of natural disasters in videos

Dataset features

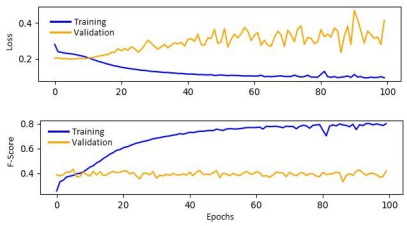
- Dataset images tagged with 32 concepts related to disaster scenes
- Greatly imbalanced dataset of high-res UAV images of different resolution and orientation
  - Resize images on same resolution preserving aspect ratio

Multi-label classification Framework

- Train a VGG-like Deep Convolutional Neural Network



- Input: RGB UAV image
- Output: Set of 32 concepts related to disaster scenes



Run:

- Consider only dataset of humanly annotated images for model training
- Extracted keyframes of 1,825 videos with a video segmentation service
- Resize images similarly to training dataset
- The mean of the probability values of the keyframes extracted for each video
- Return top-1000 results for each class

ITI-CERTH 1: Video shot annotation using VGG like DCNN predictions to extract among 32 TRECVID concepts on keyframes of videos

Results:

Submitted Run	ITI-CERTH 1
Multi-label 32 classes (F-score)	0.076

[1]. Damianos Galanopoulos and Vasileios Mezaris. Attention mechanisms, signal encodings and fusion strategies for improved ad-hoc video search with dual encoding networks. In Proc. of the ACM Int. Conf. on Multimedia Retrieval, (ICMR '20), 2020.
[2]. Jianfeng Dong, Xirong Li, Chaoxi Xu, Shouling Ji, Yuan He, Gang Yang, and XunWang. Dual Encoding for Zero-Example Video Retrieval. In Proc. of the IEEE Conf. on Computer Vision and Pattern Recognition (CVPR), 2019.

This work was partially supported by the European Commission under contracts H2020-832876 aqua3S, H2020-786731 CONNEXIONs, H2020-833115 PREVISION and H2020-780656 ReTV.