ITI-CERTH participation in TRECVID 2018

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Ad-hoc Video Search

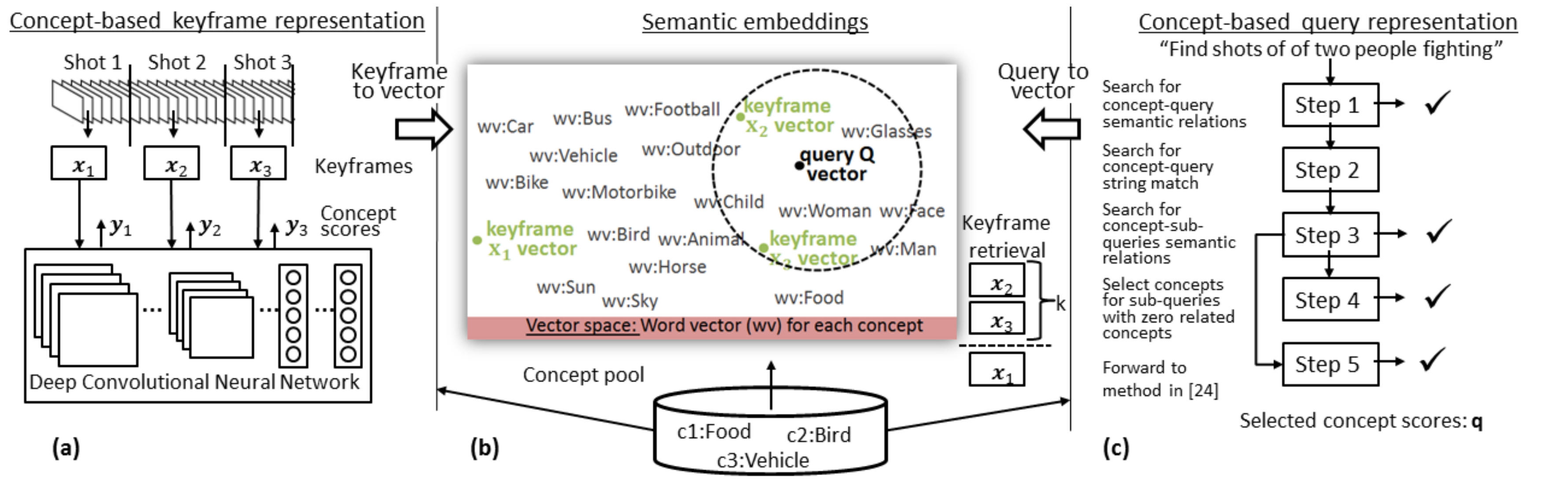
Keyframe Representation: Keyframe annotation using 33142 concept detectors.

- ImageNet 1000 - Late fusion of 5 different DCNNs.
- Pre-trained ResNet ImageNet DCNN; fine-tuned on SIN 345 concepts, plus 3 additional concepts derived from SIN.
- Pre-trained DCNNs for FCVID-239, Places-205, Places-365, Hybrid-1365 & ImageNet 4000, 4437, 8201, 12988.

Query Representation: Cue extraction and query representation as a vector of concepts. Three approaches:

i. A variety of complex NLP rules for cue extraction; multiple stages of matching cues with concepts.
ii. Cue extraction by finding noun phrases; multiple stages of cue-concept matching.
iii. Keywords are extracted by finding nouns; the most similar concept is selected for each noun.

Semantic embeddings: Both query and keyframe concept-based representations are transformed to semantic-embedding representations.



Runs:

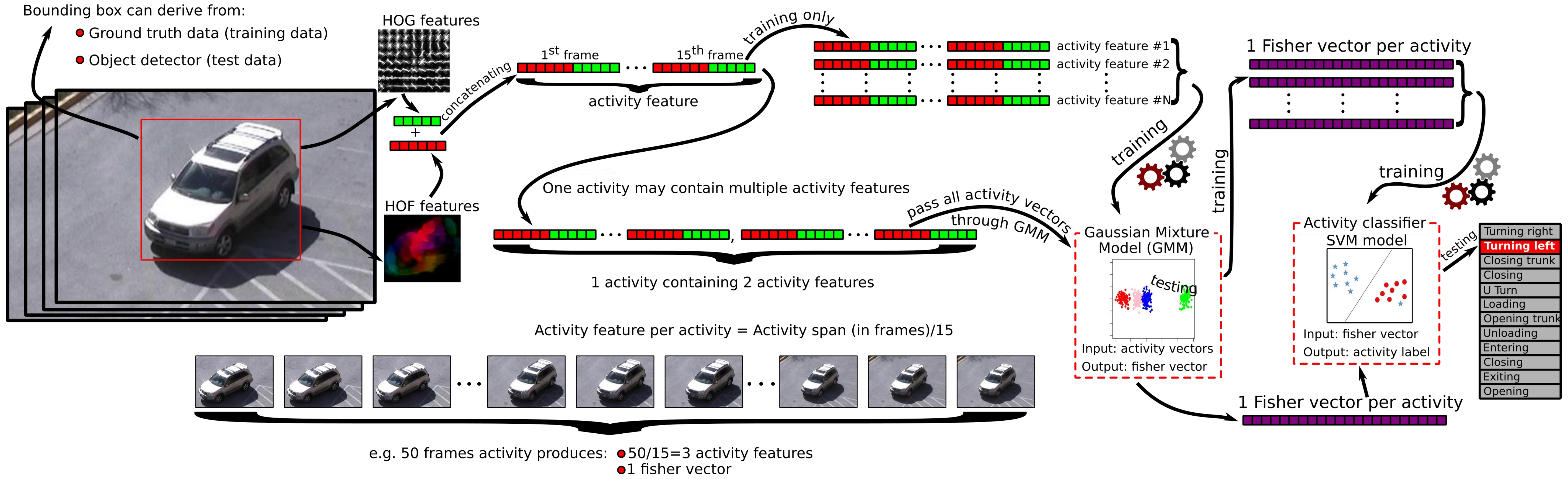
ITI-CERTH 1: Runs 2 & 4 combination (late fusion)
ITI-CERTH 2: Approach (iii) for query representation
ITI-CERTH 3: Approach (ii) for query representation
ITI-CERTH 4: Approach (i) for query representation

Results:

Run	ITI-CERTH 1	ITI-CERTH 2	ITI-CERTH 3	ITI-CERTH 4
MXinfAP	0.043	**0.047**	0.040	0.034

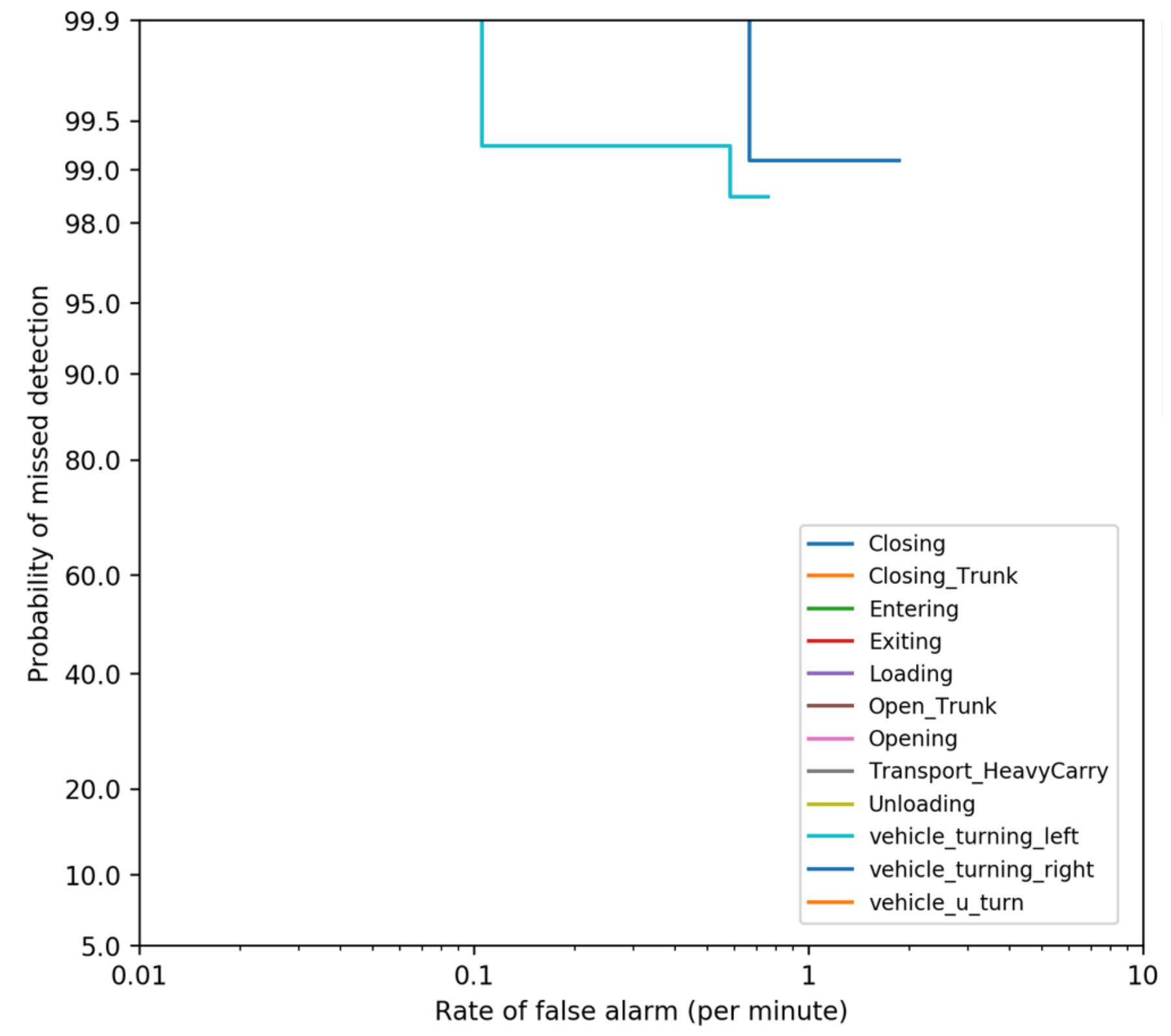
Activities in Extended Video

Activity Recognition Pipeline:


Bounding box can derive from:
● Ground truth data (training data)
● Object detector (test data)
HOG features
HOF features
+
concatenating
1st frame
15th frame
activity feature
training only
activity feature #1
activity feature #2
activity feature #N
One activity may contain multiple activity features
1 activity containing 2 activity features
pass all activity vectors through GMM
Activity feature per activity = Activity span (in frames)/15
e.g. 50 frames activity produces: ●50/15=3 activity features ●1 fisher vector
training
Gaussian Mixture Model (GMM)
testing
Input: activity vectors
Output: fisher vector
training
1 Fisher vector per activity
training
Activity classifier SVM model
Input: fisher vector
Output: activity label
1 Fisher vector per activity
testing
Turning right
Turning left
Closing trunk
Closing
U Turn
Loading
Opening trunk
Unloading
Entering
Closing
Exiting
Opening

Results:

min max	min	max
mean $P_{miss}@Rate_{FA=1AD}$	0.4536572	0.99807
mean $P_{miss}@Rate_{FA=1AOD}$	0.5576526	0.9994005



Conclusions:

- Combination of DCNNs with traditional approaches (HOG-HOF and SVM classification).
- Accuracy above 99% in training, indicates that the contestants activity features are linearly separable.
- The performance of the object detection module is vital, which in our case was not secured. For this, many activities weren't evaluated.
- An improved object detection model, as well as, an activity filter for irrelevant activities, will improve the performance.

Instance Search

VERGE video search engine modules:

High Level Visual Concept Retrieval:

- 346 TRECVID concepts using pre-trained DCNNs & Training with Linear SVMs.
- GoogLeNet CNN network for landscape recognition using the Places-205 scene categories.

Visual Similarity Search module:

- Use of pre-trained DCNN on 5055 ImageNet categories & selection of last pooling layer for keyframe representation.
- Nearest Neighbour search realized using Asymmetric Distance Computation.

Face detection and Face Retrieval Module:

- Face detection: detect faces using Tiny face detection algorithm.
- Face feature extraction: extract CNN descriptors using VGG-Very-Deep-16 CNN architecture & use of last FC layer as feature vector.
- Construction of an IVFADC index for fast face retrieval.

Scene Similarity Search Module:

- Use the feature vector of the last fully connected layer and the output of the softmax layer of the VGG16 DCNN pre-trained on Places-365 dataset.

Results:

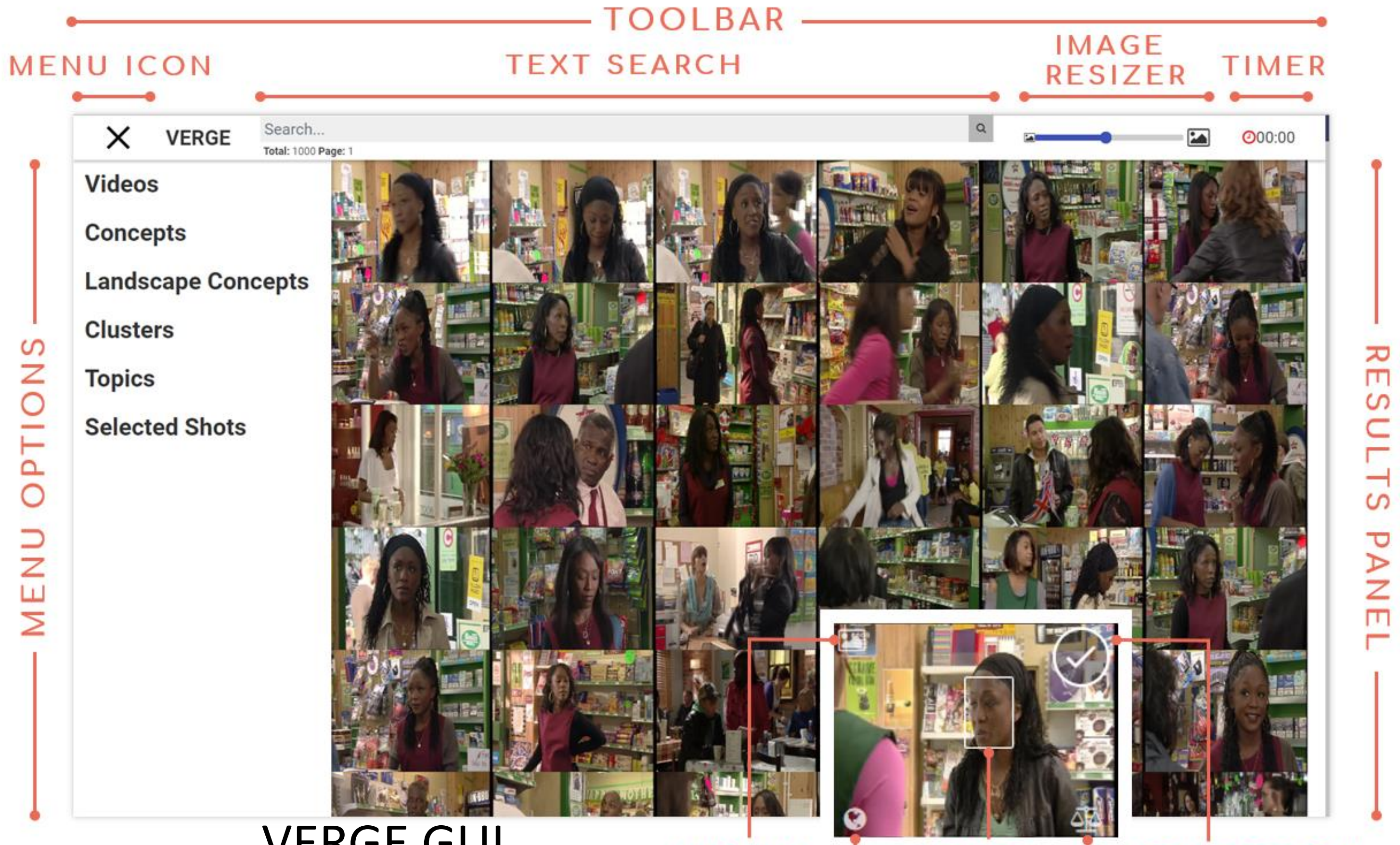
Run ID	MAP	Recall
Run 1	0.114	478/11717

Conclusion:

- High level features are extracted and combined.

VERGE graphical user interface:

- Friendly and efficient navigation.
- Various retrieval utilities, displayed in a sliding menu or as buttons.
- Shot-based representation of results.



VERGE GUI

http://mklab-services.iti.gr/verge/trec2018

Supported by: MOVING ROBORDER beAWARE