Lightweight Attentional Feature Fusion: A New Baseline for Text-to-Video Retrieval

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1. Summary

Background:

Given video/text samples represented by diverse features, we need an **optimal** way to combine these features.

Challenges:

1. Previous feature fusion SOTAs are either **too simple** (average, concatenation) or **too heavy** (Transformers).
2. Previous researches are **modality specific** and lack interpretation.

Our Solution:

Lightweight Attentional Feature Fusion (**LAFF**)

2. Proposed LAFF

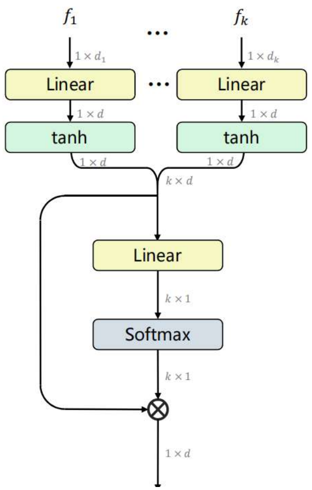


Fig.1. LAFF block

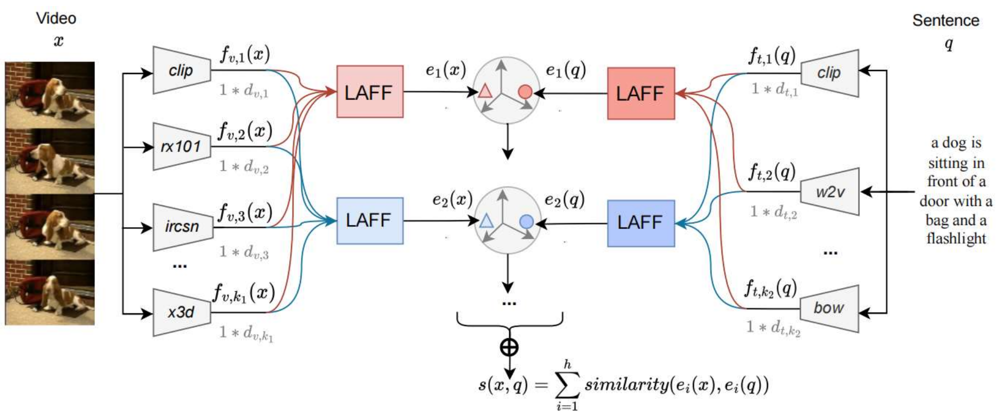


Fig.2. Paired LAFFs

2.1 The LAFF Block

- Feature transformation layer to rectify the diverse features to the same length.
- Linear and Softmax to obtain the weights of different features.

2.2 Paired LAFFs for Text-to-Video Retrieval

- LAFF for both text and video feature fusion.
- Multi-head idea to get the fusion feature for different paired LAFFs.

3. Experiments

3.1 Verification Study on MSRVTT

Feature Fusion block	Parameters	FLOPs (M)
MHSA	$D \times d + 4 \times d^2$	94.90
LAFF	$D \times d + d$	27.80

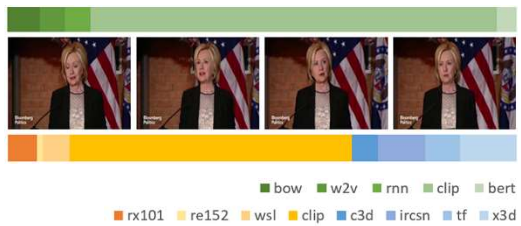
D: the overall dimension of the input features
d: the dimension of the output features

LAFF is **Lightweight**

Fusion block	R1	R5	R10	Medr	mAP
MHSA	18.8	43.0	54.6	8	0.305
LAFF	**23.7**	**49.1**	**60.6**	**6**	**0.358** (15.5%↑)

LAFF is **effective**

Hillary Clinton gives a speech on race



LAFF can **select features** according to the attentional weights

3.2 Comparison with SOTA

Model	MV-test3k			MV-test1k			MSVD			TGIF			VATEX		
	R1	*R5*	*R10*	*R1*	*R5*	*R10*	*R1*	*R5*	*R10*	*R1*	*R5*	*R10*	*R1*	*R5*	*R10*
CLIP-FT (*this paper*)	27.7	53.0	64.2	39.7	67.8	78.4	44.6	74.7	84.1	21.5	40.6	49.9	53.3	87.5	94.0
The same video and text feature as ours															
JE [41] (uniform weights)	21.2	46.5	58.4	36.0	65.9	76.4	35.9	71.0	81.8	18.7	37.5	47.1	50.2	88.7	95.4
JE (0.8 for *clip-ft*)	26.1	51.7	63.3	41.2	73.2	82.5	39.4	69.9	79.4	21.7	41.3	50.9	54.1	89.0	95.0
JE (0.9 for *clip-ft*)	25.9	51.4	63.0	40.9	72.7	82.1	38.8	69.7	78.9	21.3	40.9	50.3	53.5	88.3	94.6
W2VV++ [28]	23.0	49.0	60.7	39.4	68.1	78.1	37.8	71.0	81.6	22.0	42.8	52.7	55.8	91.2	96.0
SEA [31]	19.9	44.3	56.5	37.2	67.1	78.3	34.5	68.8	80.5	16.4	33.6	42.5	52.4	90.2	95.9
MMT [19]	24.9	50.5	62.0	39.5	68.3	78.3	40.6	72.0	81.7	22.1	42.2	51.7	54.4	89.2	95.0
LAFF	28.0	53.8	64.9	42.2	70.7	**81.2**	45.2	75.8	84.3	24.1	44.7	54.3	57.7	91.3	95.9
LAFF-ml	**29.1**	**54.9**	**65.8**	**42.6**	**71.8**	81.0	**45.4**	**76.0**	**84.6**	**24.5**	**45.0**	**54.5**	**59.1**	**91.7**	**96.3**
Comparison with arXiv SOTA															
CLIP2Video [17]	n.a	n.a	n.a	44.5	71.3	80.6	44.7	74.8	83.7	n.a	n.a	n.a	54.8	89.1	95.1
LAFF	n.a	n.a	n.a	**45.8**	**71.5**	**82.0**	**45.4**	**75.5**	**84.1**	n.a	n.a	n.a	**58.3**	**91.7**	**96.3**

- With the same video and text feature, LAFF perform best compare to Baselines.
- Including the global video/text features extracted by CLIP2Video (arXiv SOTA), LAFF can flexibly harness new and more powerful features.