Text-Visual Prompting for Efficient 2D Temporal Video Grounding

Yimeng Zhang[1,2], Xin Chen[2], Jinghan Jia[1], Sijia Liu[1], Ke Ding[2]
[1]OPTML lab, Michigan State University, [2]Applied ML, Intel

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Introduction

- **What is temporal video grounding (TVG) ?**

TVG is to predict the **starting/ending time points** of moments described by a text sentence within a long untrimmed video.

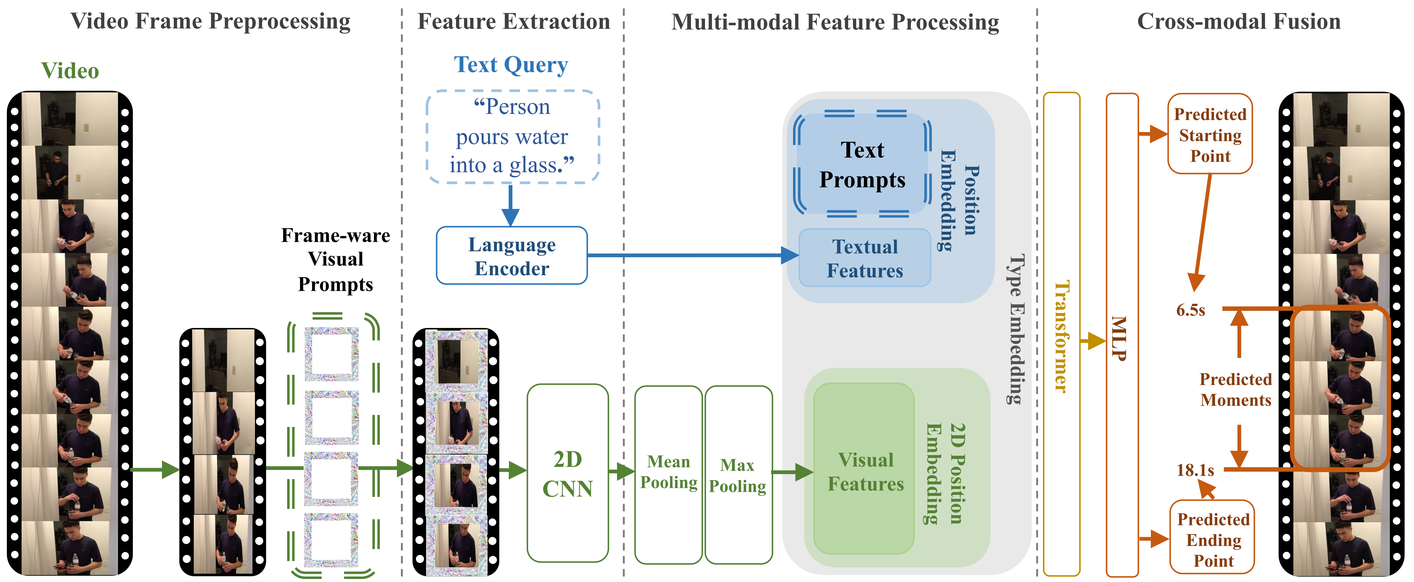
- **Motivation**

High complexity of 3D CNNs makes extracting dense 3D visual features time-consuming, which calls for intensive memory and computing resources.

- **Challenges**

How to advance 2D TVG methods so as to achieve comparable results to 3D TVG methods?

Text-Visual Prompting (TVP) Framework for TVG



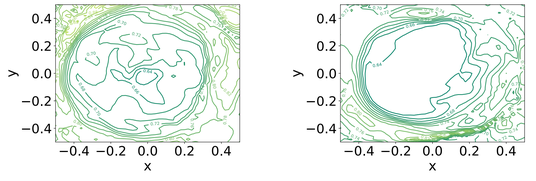
Loss Function: TD-IoU Loss

$$\mathcal{L} = \mathcal{L}_{\text{tIoU}} + \beta_1 \mathcal{L}_{\text{dis}} + \beta_2 \mathcal{L}_{\text{dur}}$$

$$\mathcal{L}_{\text{tIoU}} = \left(1 - \frac{\hat{\mathbf{T}}(\boldsymbol{\theta}) \bigcap \mathbf{T}}{\hat{\mathbf{T}}(\boldsymbol{\theta}) \bigcup \mathbf{T}}\right) \qquad \mathcal{L}_{\text{dur}} = \max\left(\frac{|\mathbf{T} - \hat{\mathbf{T}}(\boldsymbol{\theta})|}{|\mathbf{T}|}, \alpha_2\right)$$

$$\mathcal{L}_{\text{dis}} = \max\left(\frac{|\left(t_{\text{sta}} + t_{\text{end}}\right)/2 - \left(\hat{t}_{\text{sta}} + \hat{t}_{\text{end}}\right)/2|}{|\hat{\mathbf{T}} \bigcup \mathbf{T}|}, \alpha_1\right)$$

Loss Landscape Analysis



Overall Results

- **Charades-STA**

Type	Method	Visual Feature	Acc(R@1, IoU=m) m=0.3	m=0.5	m=0.7
3D TVG	CTRL [14]	C3D	-	23.63	8.89
	ABLR [67]	C3D	-	24.36	9.01
	BPNet [62]	C3D	55.46	38.25	20.51
	LPNet [61]	C3D	59.14	40.94	21.13
	QSPN [64]	C3D	54.70	35.60	15.80
	TSP-PRL [60]	C3D	-	45.45	24.75
	TripNet [18]	C3D	54.64	38.29	16.07
	DRN [69]	C3D	-	45.40	26.40
	CPNet [34]	C3D	-	40.32	22.47
	DEBUG [43]	C3D	54.95	37.39	17.92
	ExCL [16]	I3D	61.50	44.1	22.40
	VSLNet [73]	I3D	64.30	**47.31**	**30.19**
	MAN [71]	I3D	-	46.53	22.72
2D TVG	MCN [1]	VGG	-	17.46	8.01
	SAP [7]	VGG	-	27.42	13.36
	Ours				
TVP-Based 2D TVG	Base w/o prompts	ResNet	61.29	40.43	19.89
	Base + Visual Prompts		65.38	44.31	20.22
	Base + Text Prompts		65.81	43.44	20.65
	Base + Both Prompts		**65.92**	44.39	21.51

- **ActivityNet Captions**

Type	Method	Visual Feature	Acc(R@1, IoU=m) m=0.3	m=0.5	m=0.7
3D TVG	CTRL [14]	C3D	28.70	14.00	-
	BPNet [62]	C3D	59.98	42.07	24.69
	LPNet [61]	C3D	**64.29**	**45.92**	25.39
	QSPN [64]	C3D	45.30	27.70	13.60
	TSP-PRL [60]	C3D	56.02	38.83	-
	TripNet [18]	C3D	48.42	32.19	13.93
	DRN [69]	C3D	-	45.45	24.36
	CPNet [34]	C3D	-	40.56	21.63
	ABLR [67]	C3D	55.67	36.79	-
	DEBUG [43]	C3D	55.91	39.72	-
	ExCL [16]	C3D	63.00	43.60	24.10
	VSLNet [73]	C3D	63.16	43.22	**26.16**
	Ours				
TVP-Based 2D TVG	Base w/o prompts	ResNet	57.20	40.16	19.14
	Base + Visual Prompts		60.12	43.39	23.71
	Base + Text Prompts		60.48	42.58	24.39
	Base + Both Prompts		60.71	43.44	25.03