GaitMM: Multi-Granularity Motion Sequence Learning for Gait Recognition

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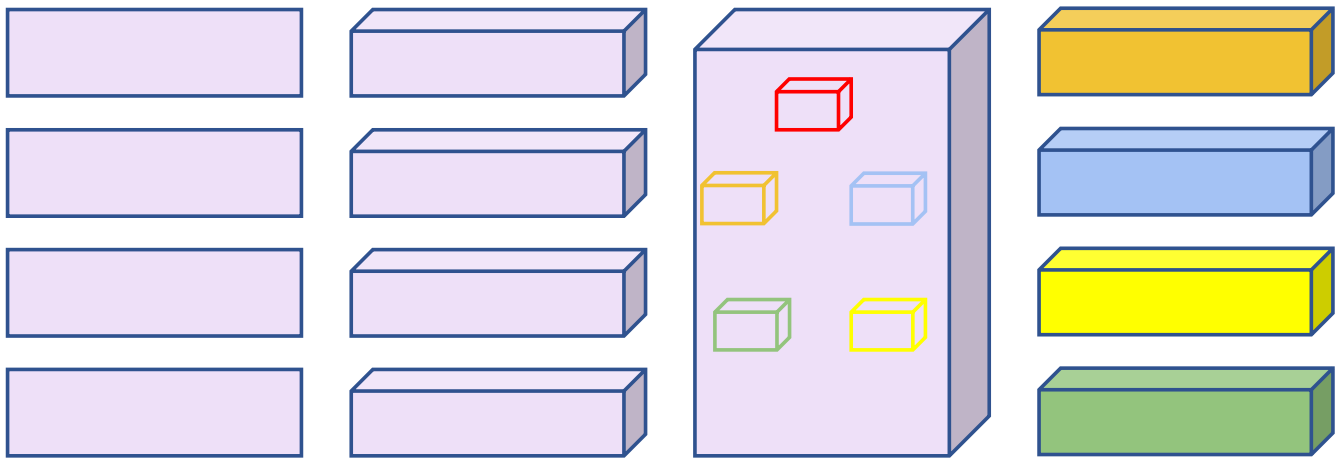
Highlights

- We propose a gait recognition framework named GaitMM, which combines global and fine-grained motion information for gait sequence learning.
- We propose an adaptive MSMA module that reduces redundancy in the gait sequence.
- Experimental results on two public datasets, CASIA-B and OUMVLP, demonstrate that our method achieves state-of-the-art performance.

Motivation



(a) GaitPart [3] (b) GaitGL [6] (c) 3D Local [5] (d) Ours [7]

Figure 1: Illustrations of different splitting strategies. We adopt the same strategy as GaitGL [6] but handle each part sequence independently.

Motivation

Figure 2: There is redundant information between frames.

Through observation, we found that adjacent frames are highly similar, which indicates that there is a large amount of redundant information between frames. Therefore, it is necessary to eliminate redundant information and enhance discriminative information through time dimension downsampling.

GaitMM

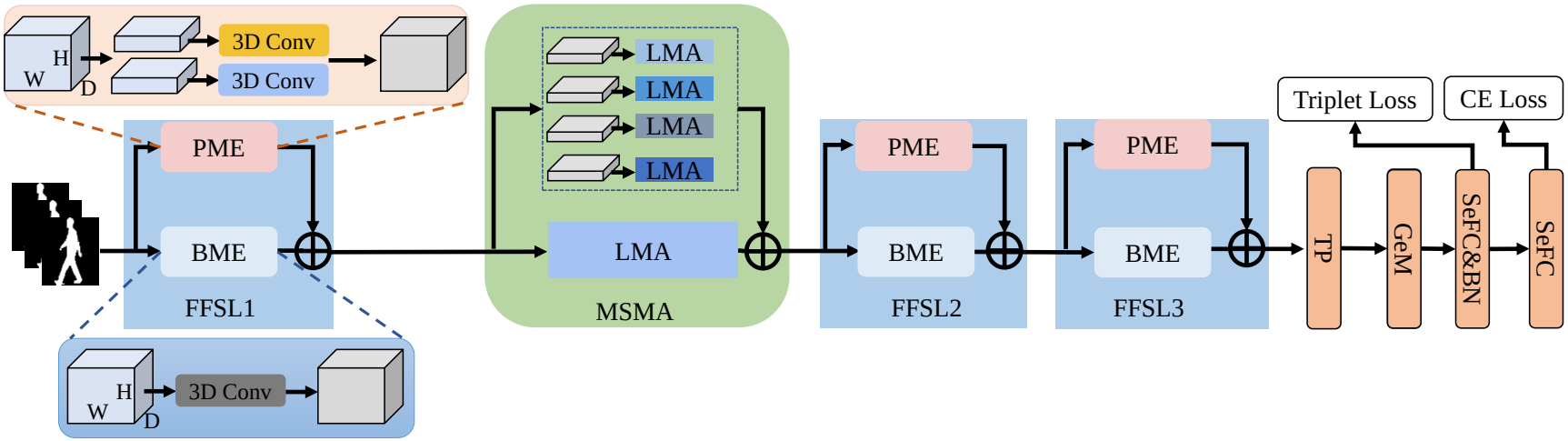


Figure 3: Pipeline of GaitMM.

Results of CASIA-B

Table 1: Rank-1 accuracy (%) on CASIA-B under different conditions, excluding identical-view cases.

Method	Venue	Year	Param	NM	BG	CL	Mean
GaitSet[1]	AAAI	2019	2.6M	95.0	87.2	70.4	84.2
GaitPart[3]	CVPR	2020	1.5M	96.2	91.5	78.7	88.8
GaitGL[6]	ICCV	2021	3.1M	97.4	94.5	83.6	91.8
CSTL[4]	ICCV	2021	9.1M	97.8	93.6	84.2	91.9
3D Local[5]	ICCV	2021	10.2M	97.5	94.3	83.7	91.8
Ours(depthwise convolution)	-	-	4.1M	97.5	94.8	85.4	92.6
Ours	-	-	9.8M	98.0	95.6	87.2	93.6

Results of OUMVLP

Table 2: Rank-1 accuracy (%) on OUMVLP under all views, excluding identical-view cases.

	Gallery All 14 views				
Probe	GaitSet[2]	GaitPart[3]	GaitGL[6]	3D Local[5]	**Ours**
0°	84.5	88.0	90.5	-	**92.9**
15°	93.3	94.7	96.1	-	**97.1**
30°	96.7	97.7	98.0	-	**98.4**
45°	96.6	97.7	98.1	-	**98.4**
60°	93.5	95.5	97.0	-	**97.5**
75°	95.3	96.6	97.6	-	**98.0**
90°	94.2	96.2	97.1	-	**97.7**
180°	87.0	90.6	94.2	-	**95.8**
195°	92.5	94.2	94.9	-	**96.3**
210°	96.0	97.2	97.4	-	**97.8**
225°	96.0	97.1	97.4	-	**97.8**
240°	93.0	95.1	95.7	-	**96.4**
255°	94.3	96.0	96.5	-	**97.1**
270°	92.7	95.0	95.7	-	**96.6**
Mean	93.3	95.1	96.2	96.5	**97.0**

Ablation Studies

Table 3: Ablation study on FFSL and MSMA.

FFSL		MSMA	Rank-1 Accuracy			
BME	PME		NM	BG	CL	Mean
✓			97.1	94.4	84.1	91.9
✓	✓		97.8	95.2	85.2	92.7
✓		✓	97.1	94.0	85.1	92.1
✓	✓	✓	**98.0**	**95.6**	**87.2**	**93.6**

Trade-off

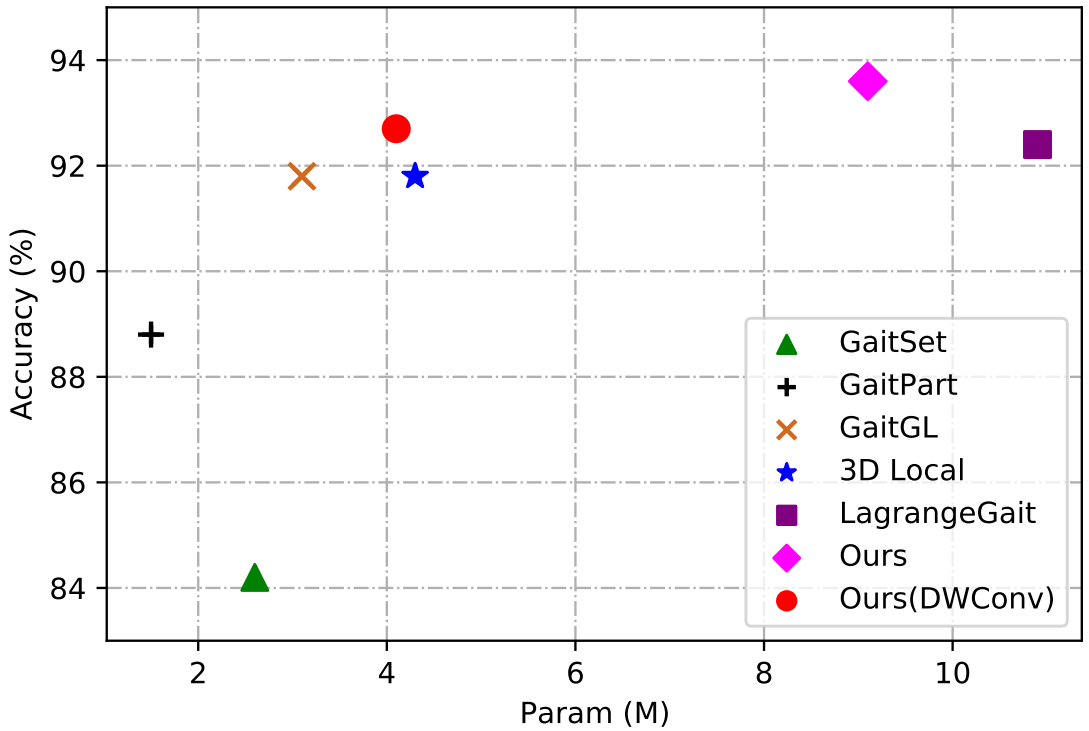


Figure 4: The trade-off between accuracy and parameters of our method and other comparison methods on CASIA-B.

Conclusion

- This paper proposes GaitMM, a novel gait recognition framework that integrates fine-grained and global motion properties.
- The FFSL module is designed to learn the part-based sequence and body representations, while the MSMA operation aggregates sequence information by compressing redundant frames.
- We conduct extensive experiments on two public datasets to demonstrate the effectiveness of GaitMM.

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Thanks!