JT-MGCN: Joint-temporal Motion Graph Convolutional Network for Skeleton-Based Action Recognition

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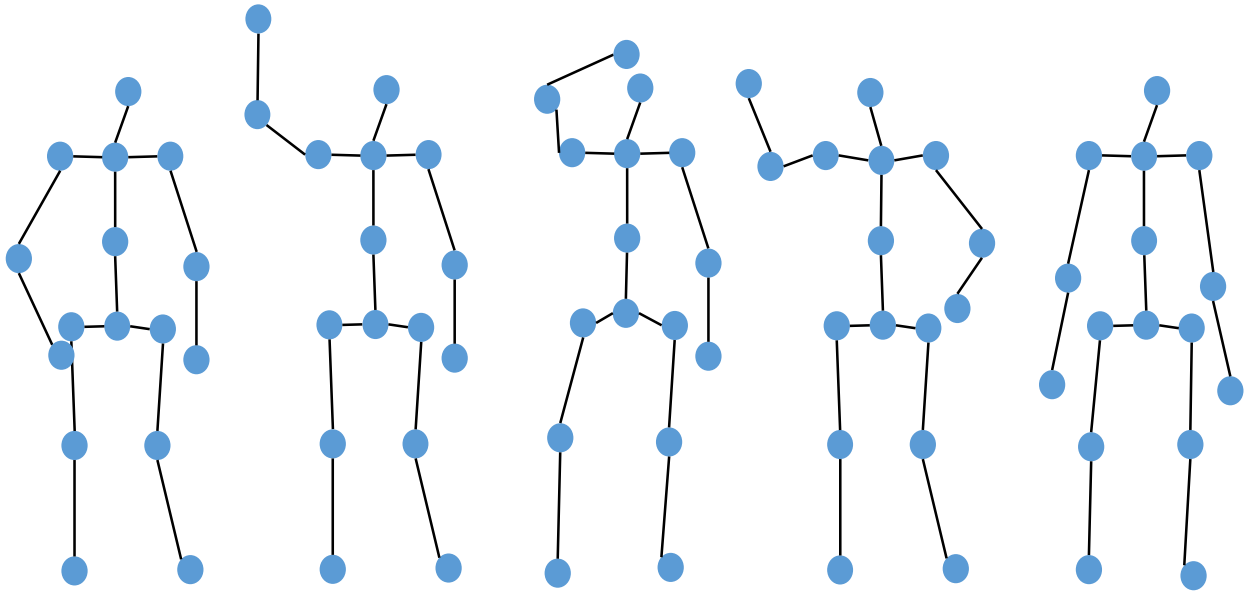
Introduction

Skeleton-Based Action Recognition



- Without other different features
- Obtaining from RGB images or Depth cameras

Introduction

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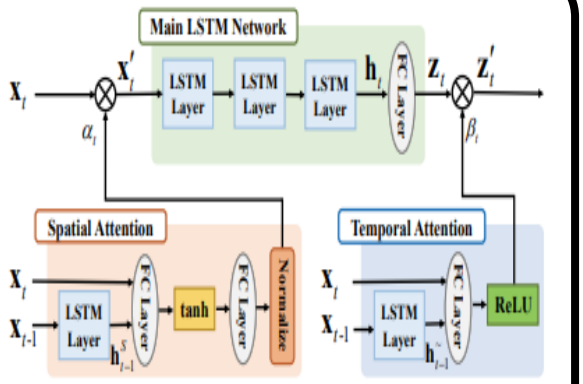
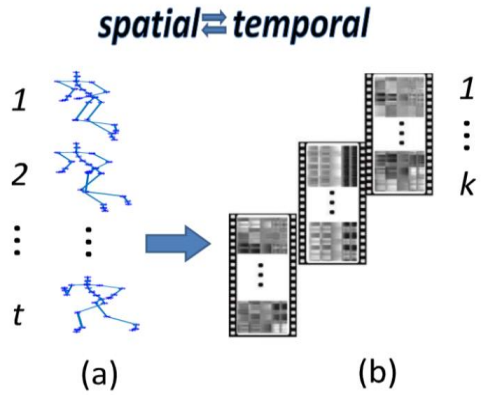
RNN based algorithm



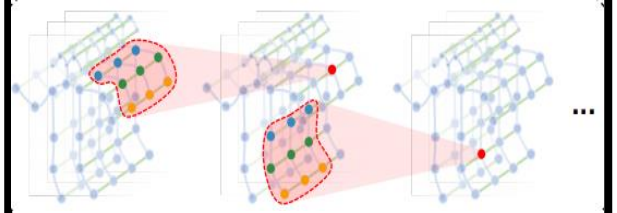
Song, Sijie, et al. "An end-to-end spatio-temporal attention model for human action recognition from skeleton data." AAAI 2017

CNN based algorithm



Ke, Qiuhong, et al. "Learning clip representations for skeleton-based 3D action recognition." IEEE Transactions on Image Processing

GCN based algorithm

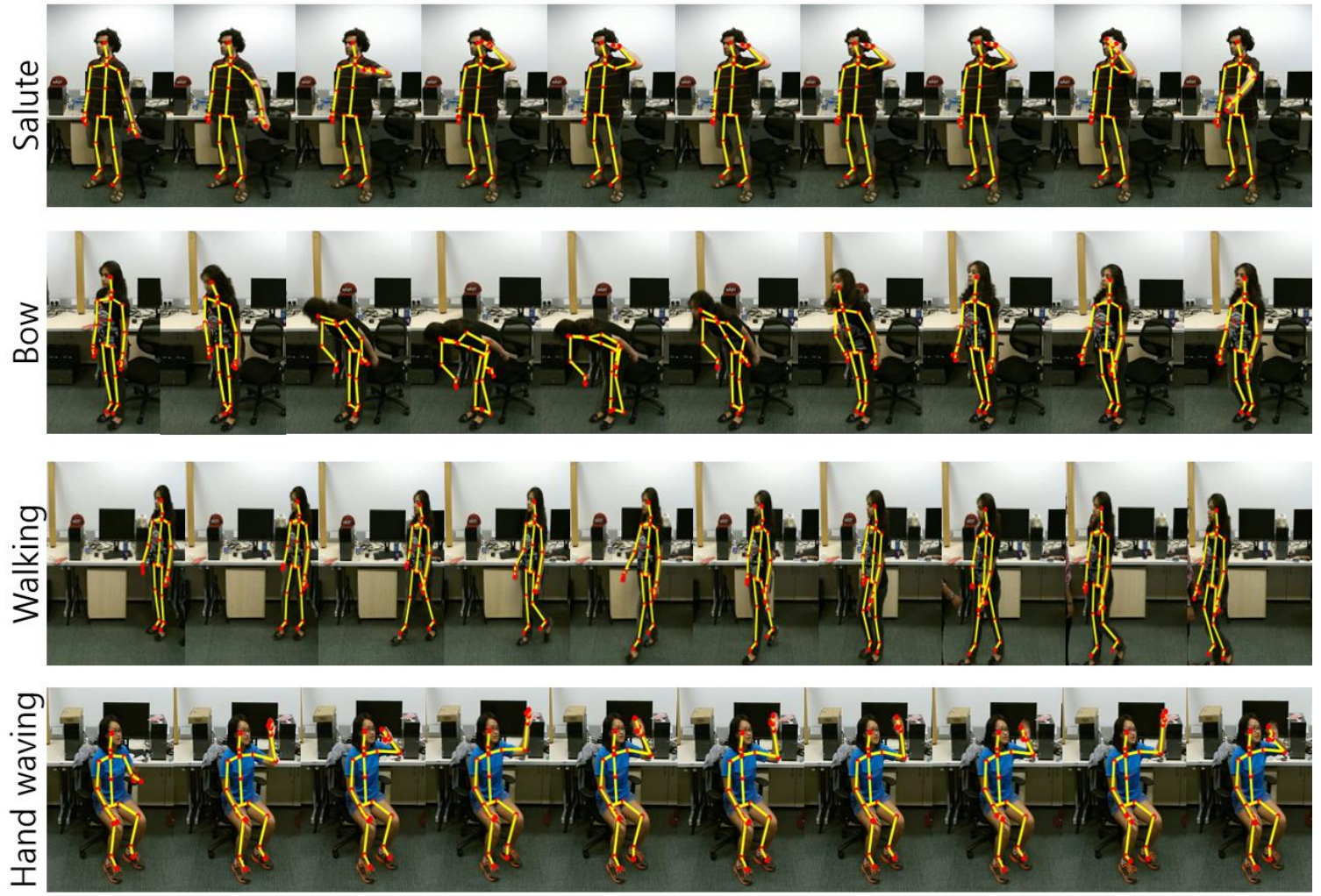


Yan, Sijie, Yuanjun Xiong, and Dahua Lin. "Spatial temporal graph convolutional networks for skeleton-based action recognition." AAAI2018.

	HBRNN[2]	PA-LSTM[17]	ST-LSTM+TS[12]	GCA-LSTM[13]	VA-LSTM[26]	STA-LSTM[22]	2S 3D CNN[11]	MTLN[4]	Res-TCN[6]	MS deep CNN[7]	MS CNN[14]	Motion+Trans[8]	ST-NBMIM[24]	DPRN+GCNN[23]	ARRN-LSTM[28]	SR-TSL[21]	IndRNN[10]	(P+C)Net[1]	AE-LSTM[16]	MTCNN[5]	ST-GCN[25]	AS-GCN[9]	AGC-LSTM[20]	2S-AGCN[19]	DGNN[18]	BGC-LSTM[27]
RNN	v	v	v	v	v	v								v		v	v	v	v	v				v			v
CNN							v	v	v	v	v	v	v							v	v						
GCN															v	v						v	v	v	v	v	v
		2016		2017										2018									2019				

Problem

There are relationship between time and joint



Problem

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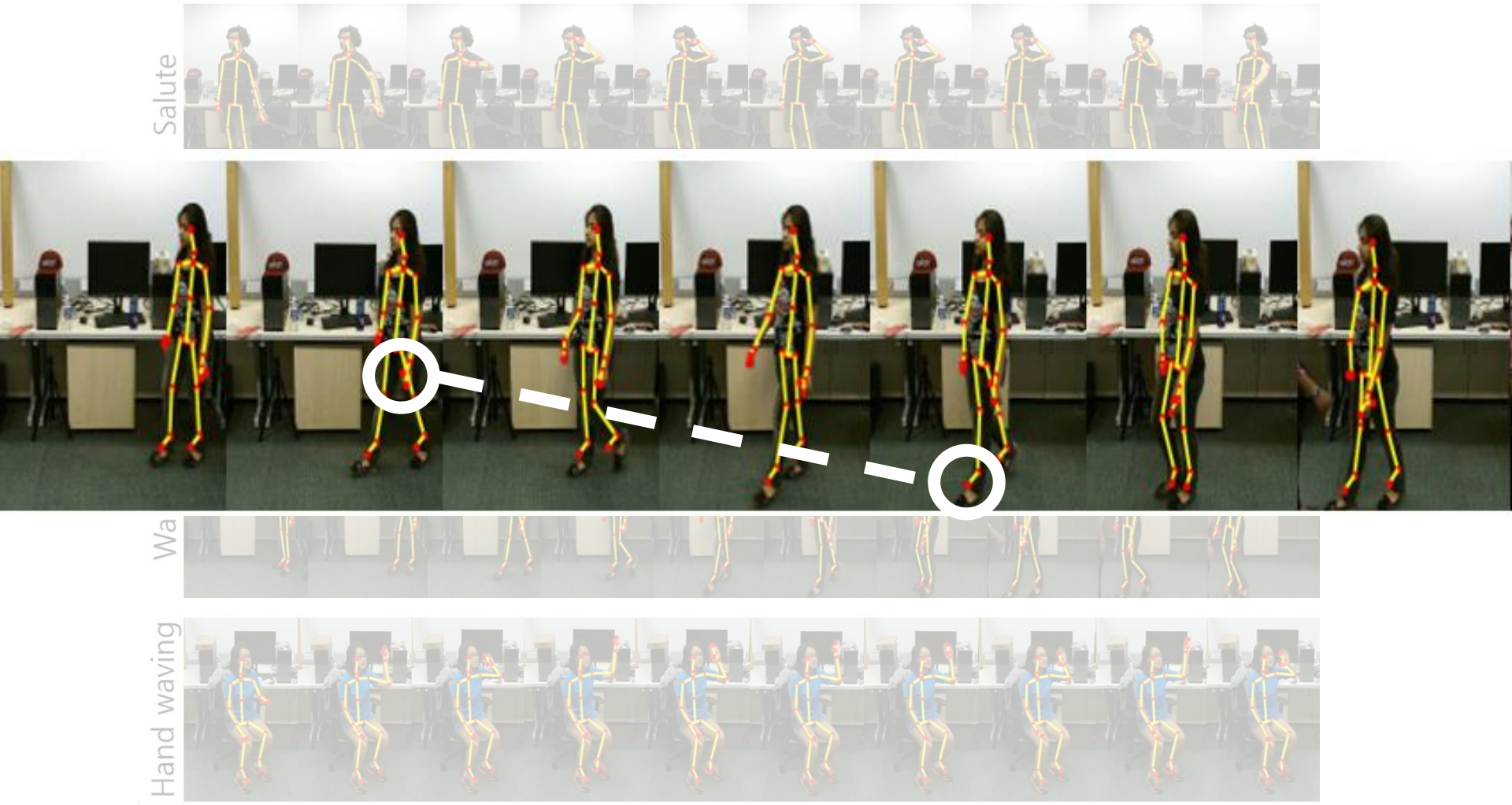
There are relationship between time and joint



Proposed algorithm

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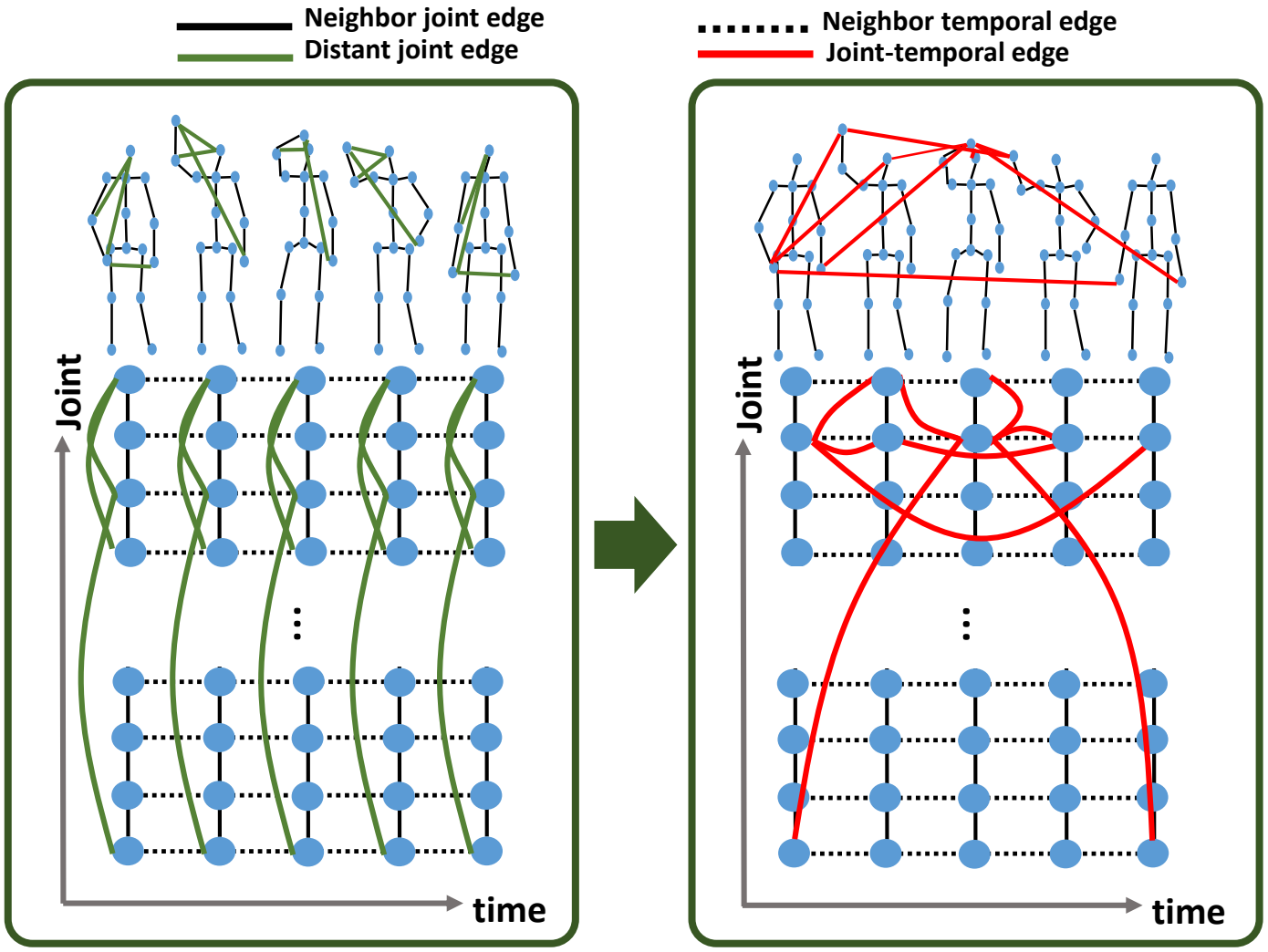

2S-AGCN, Shi et al. *CVPR* 2019.

Our proposed algorithm

Proposed algorithm

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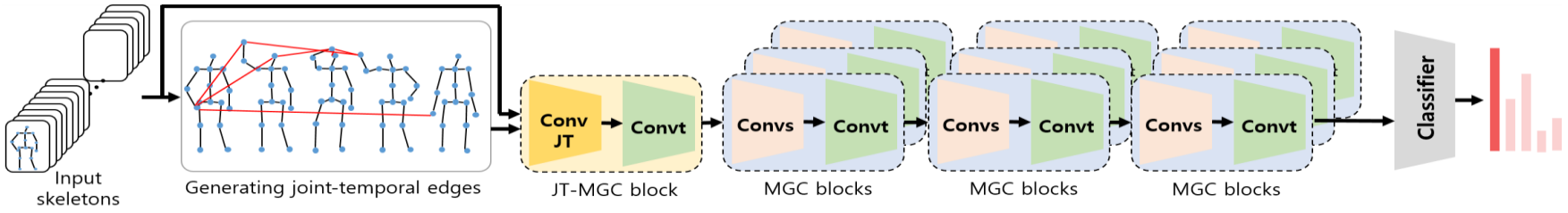
Overall frameworks



Proposed algorithm

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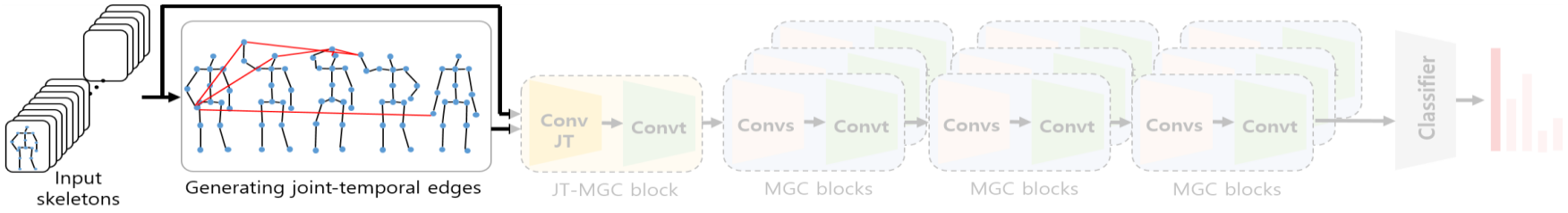
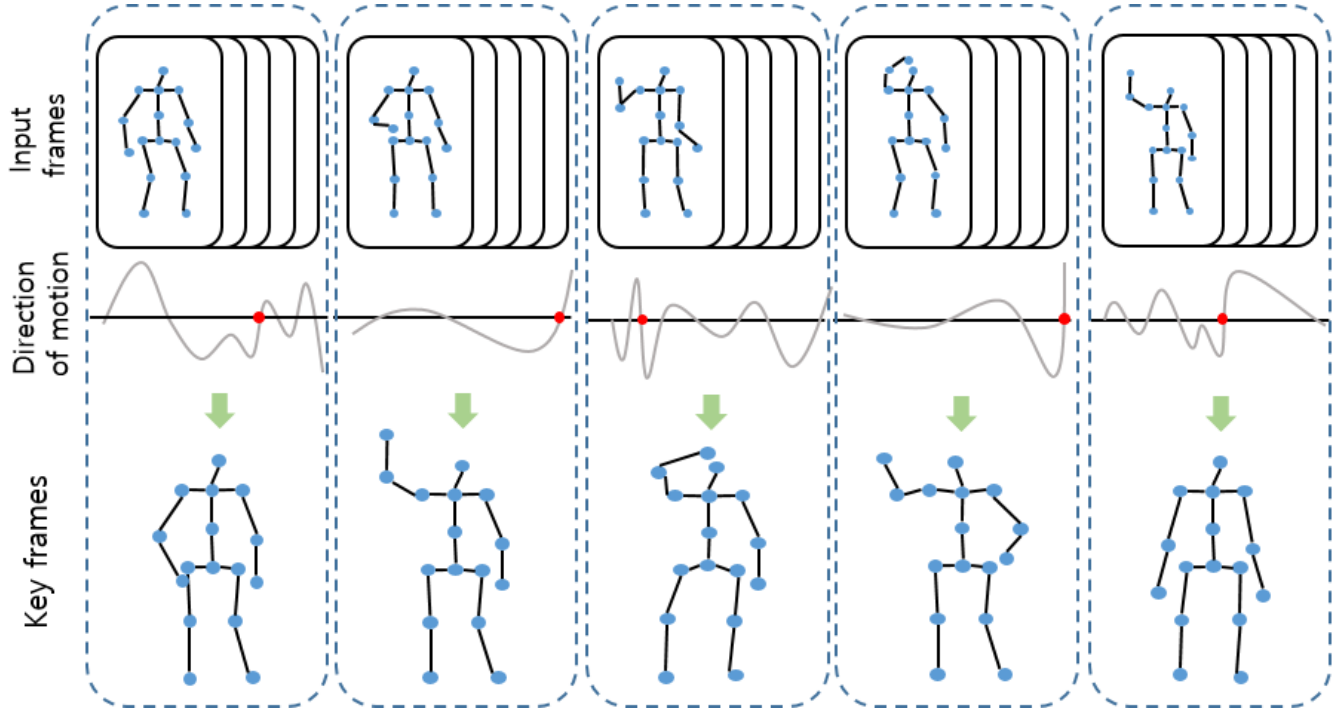
Overall frameworks



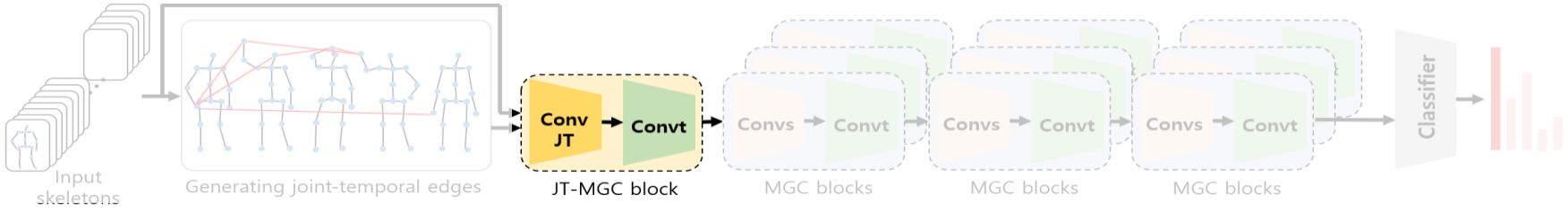
Frame Sampling



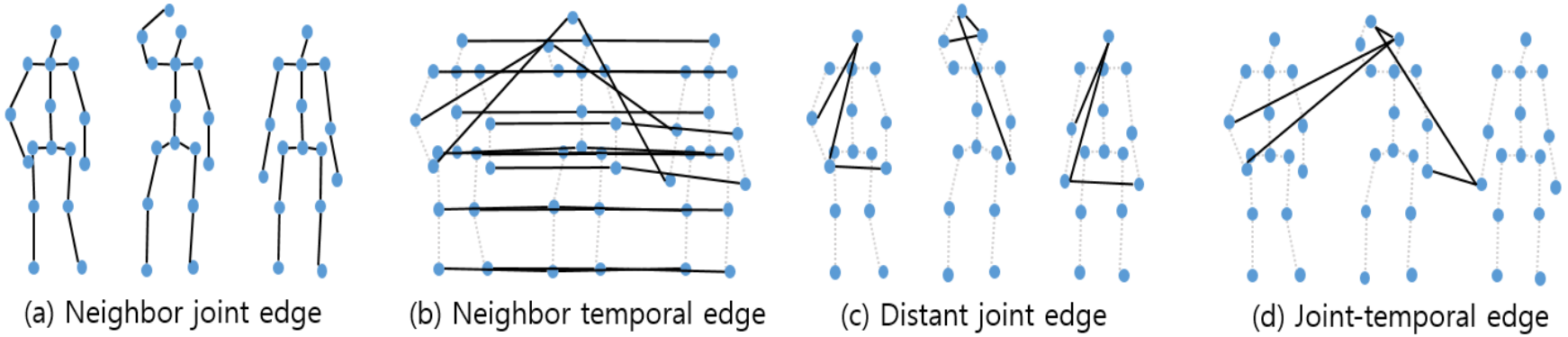
Reducing computational cost!

Proposed algorithm(2)

Overall frameworks



Generating various edges



(a) Neighbor joint edge (b) Neighbor temporal edge (c) Distant joint edge (d) Joint-temporal edge

Way to make JT edges

1) Learnable parameter 2) Encoder-Decoder model

Proposed algorithm

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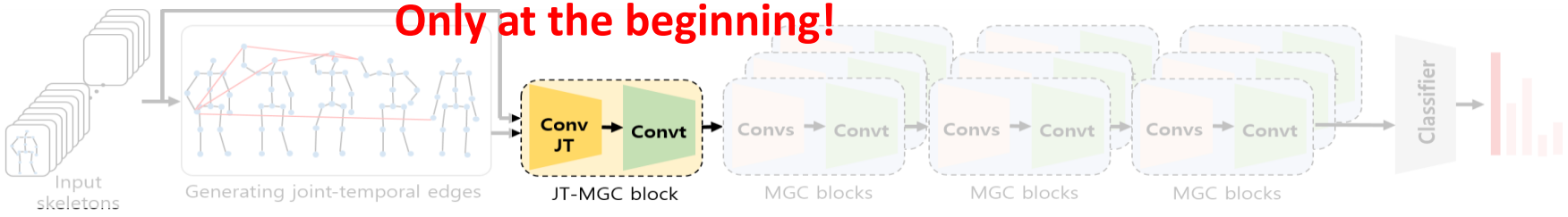
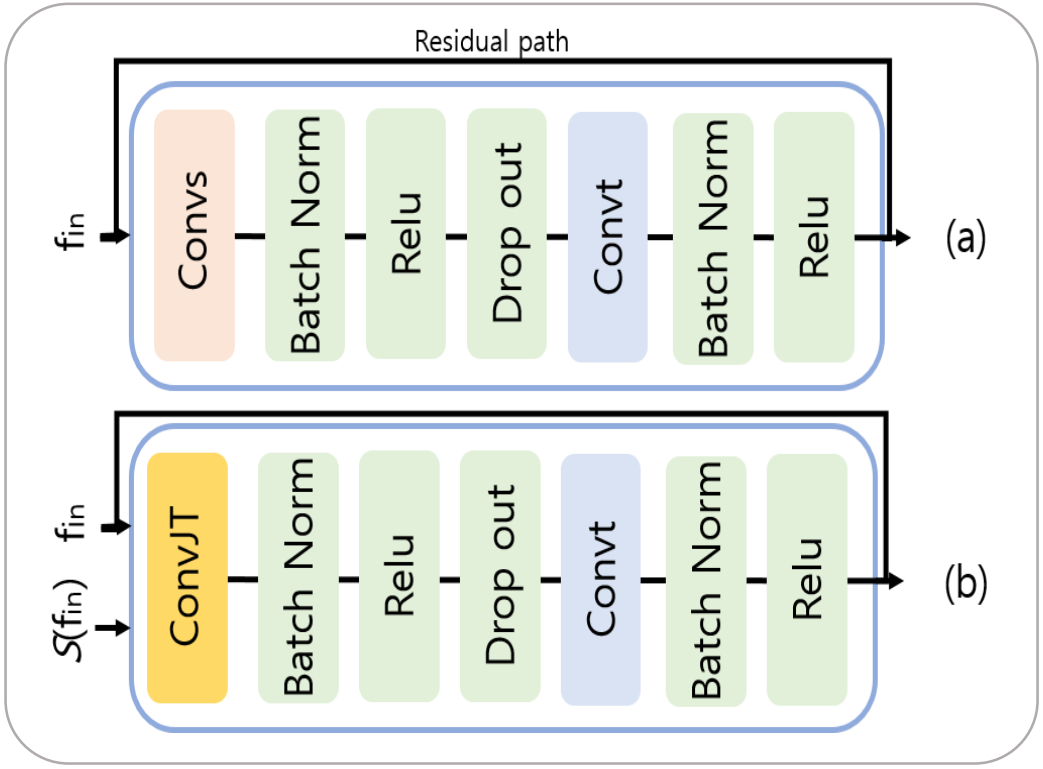
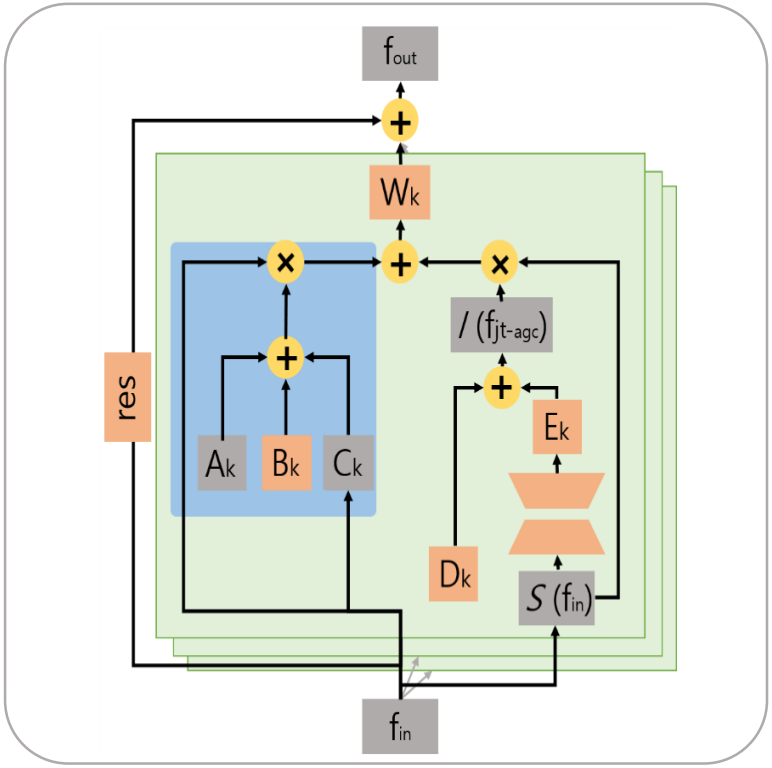
Overall frameworks



JT-MGC block



ConvJT



Proposed algorithm

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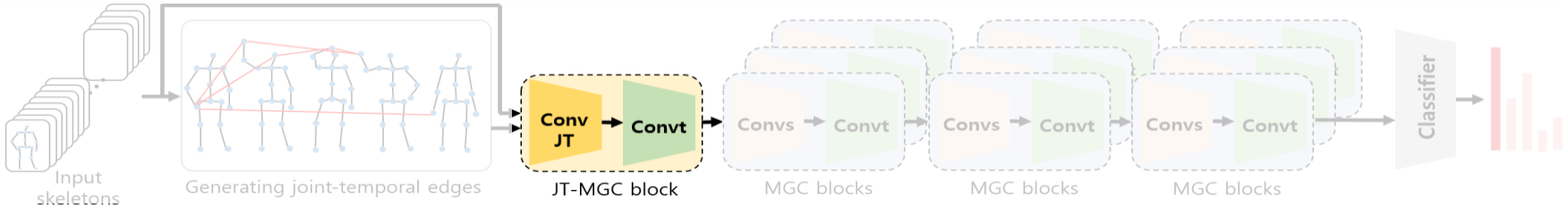
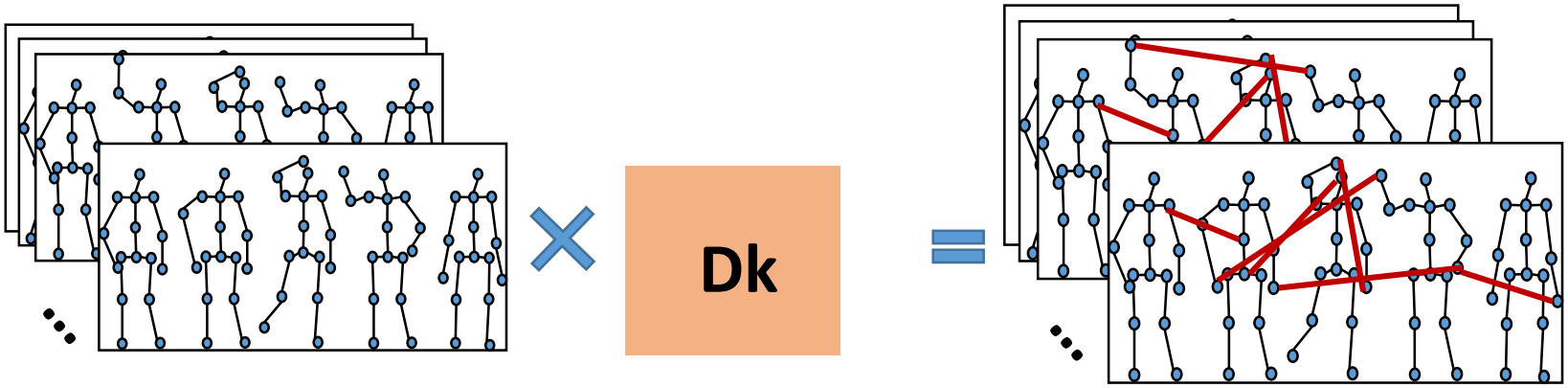


1) Multiply Learnable Parameters - Dk



Different subjects

Metrix for common JT edges

Same JT edges for every subjects

Proposed algorithm

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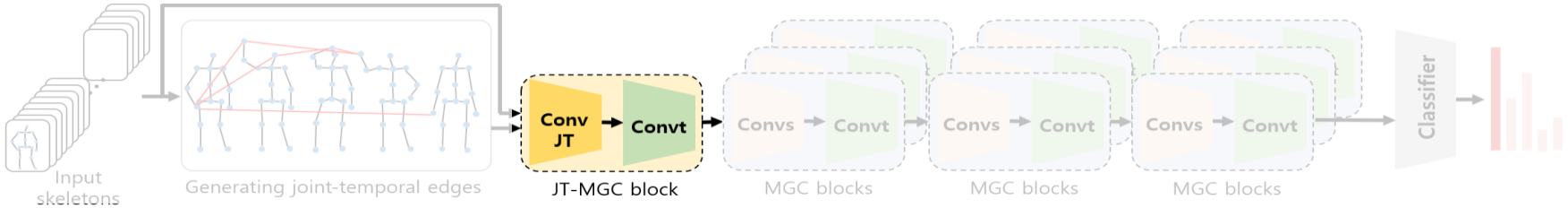
Overall frameworks



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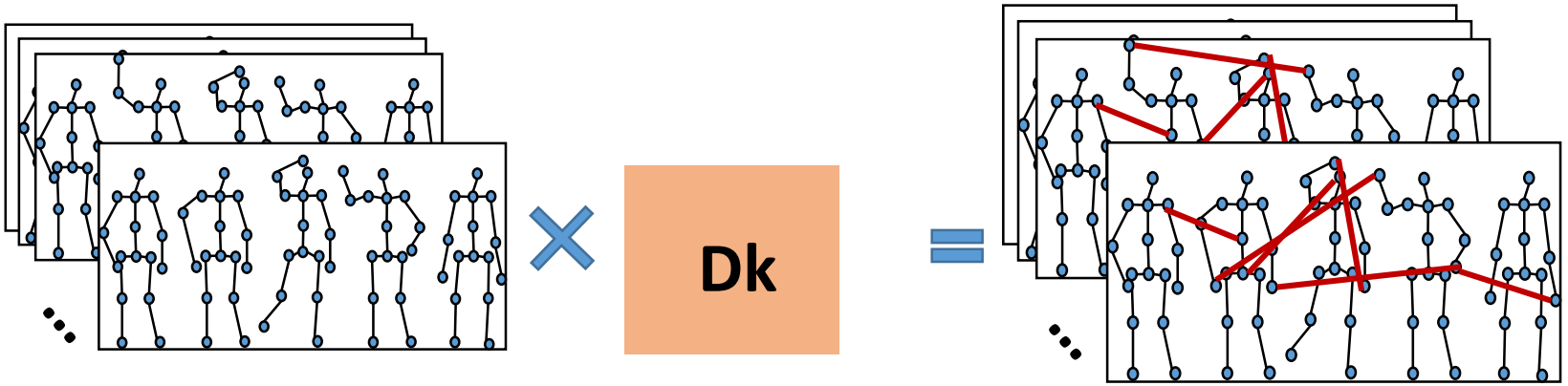


Different subjects

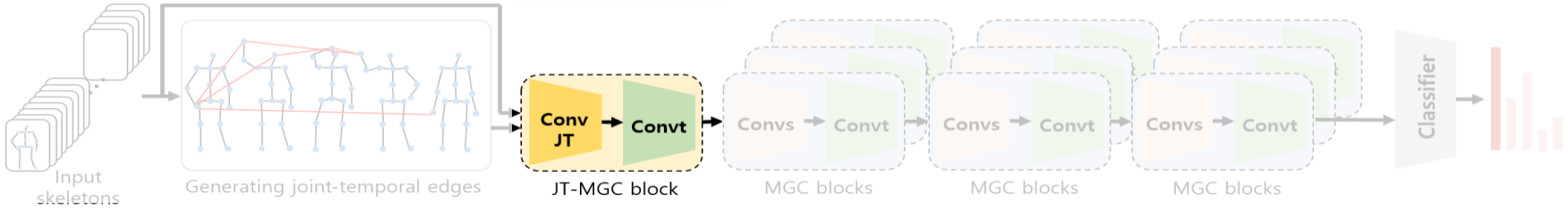
Metrix for common JT edges

Same JT edges for every subjects

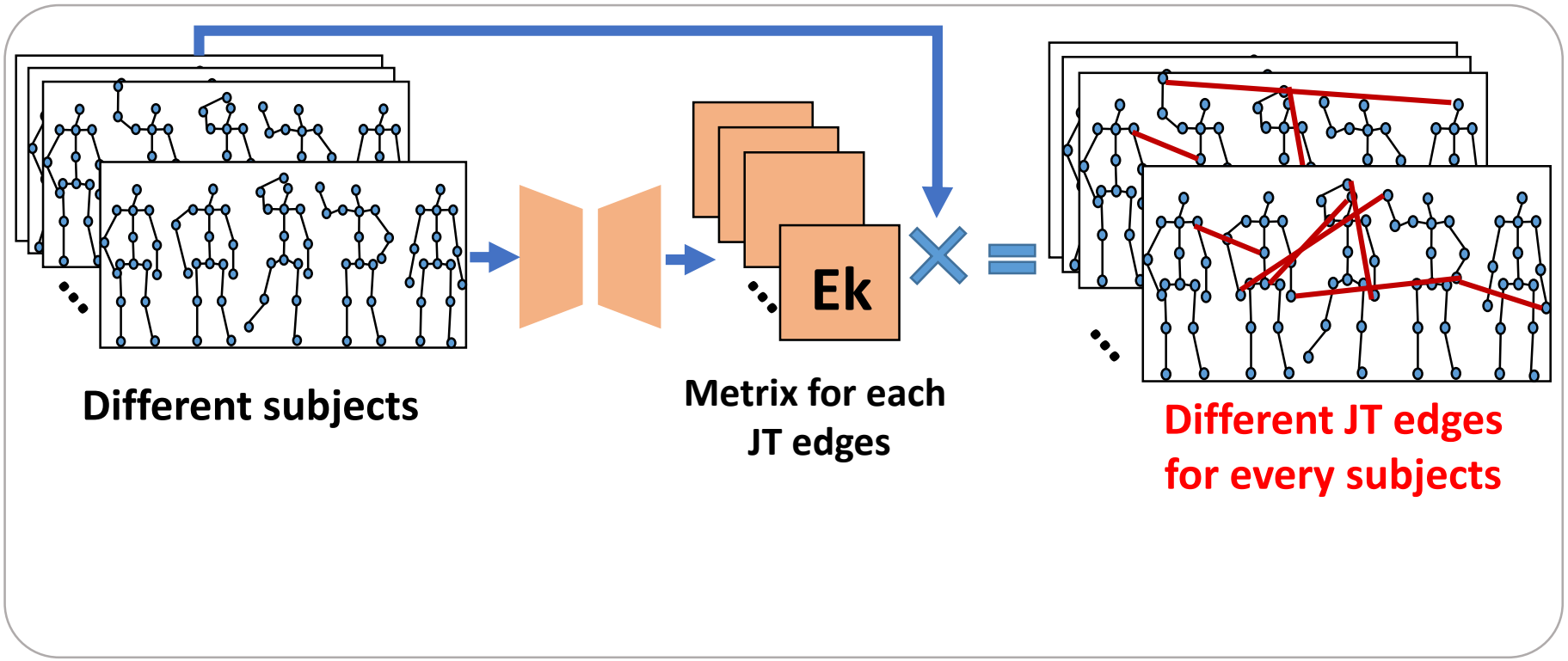
Updating weights based on outputs

Proposed algorithm

Overall frameworks



2) Multiply matrix through encoder-decoder - Ek



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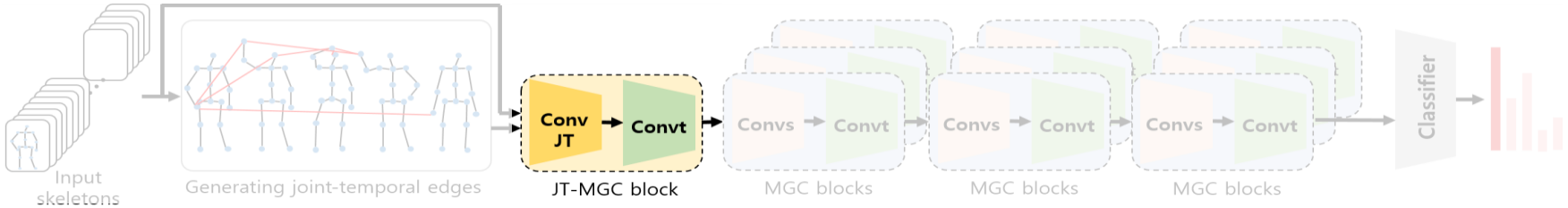

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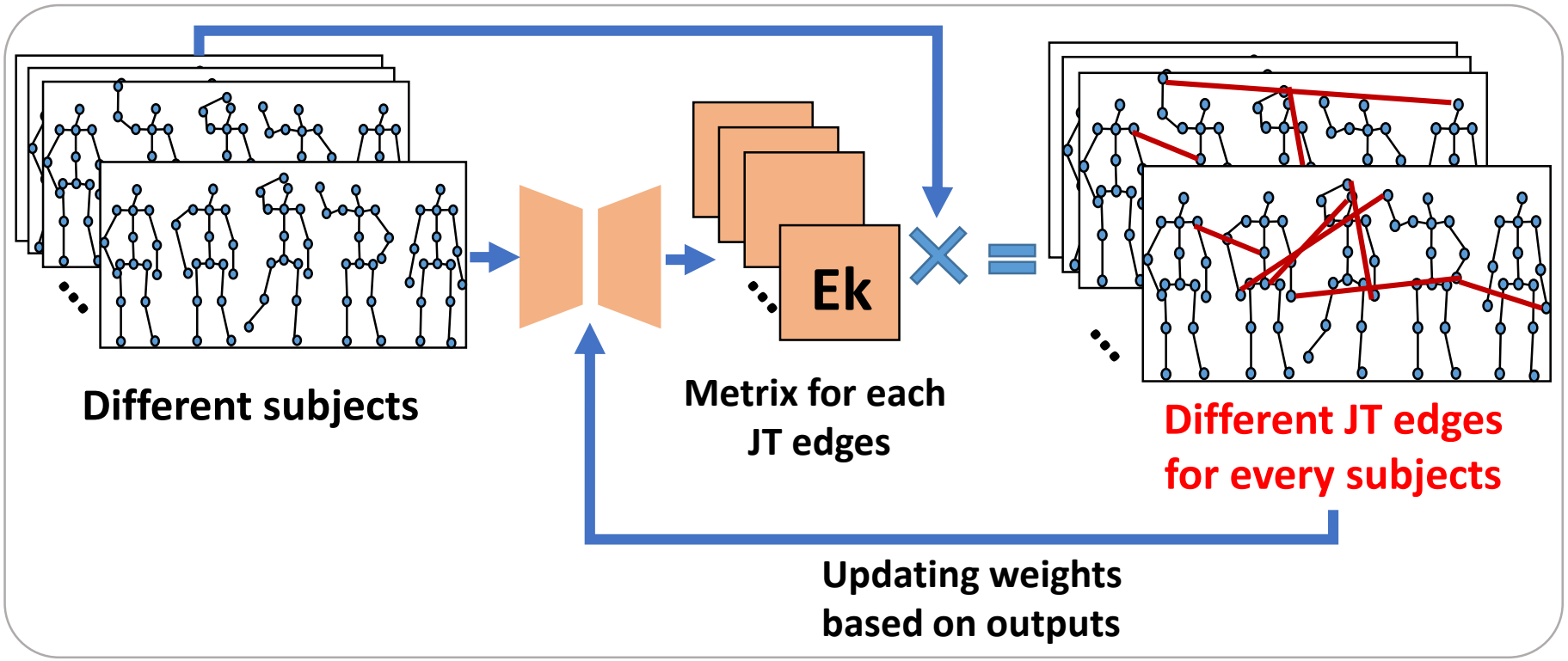
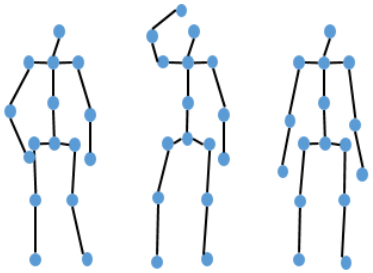
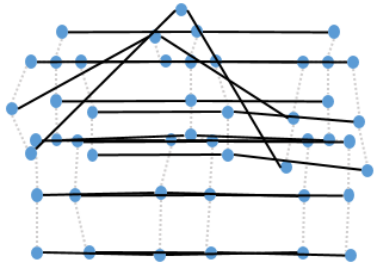


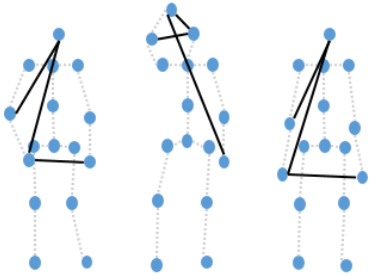
Results



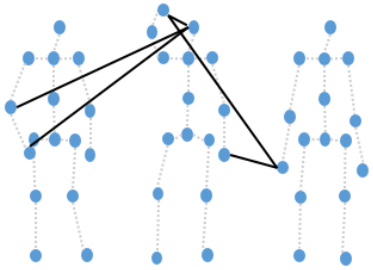
(a) Neighbor joint edge



(b) Neighbor temporal edge



(c) Distant joint edge

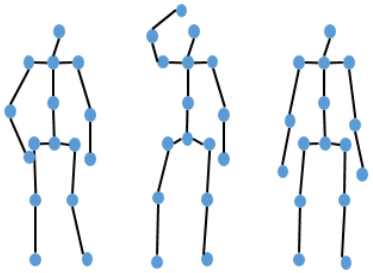


(d) Joint-temporal edge

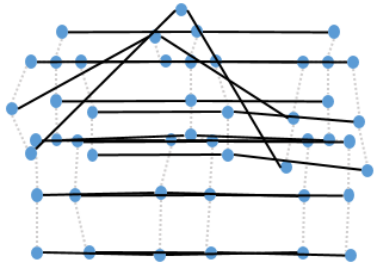
method	CS(%)
(a)+(b)	81.5
(a)+(b)+(c)	88.5
(a)+(b)+(c)+(d)	**90.4**

Method	Year	CS(%)	CV(%)
PA-LSTM [18]	2016	62.9	70.3
ST-LSTM+TS [13]	2016	69.2	77.7
STA-LSTM [23]	2017	73.4	81.2
VA-LSTM [27]	2017	79.4	87.6
MTLN [5]	2017	79.6	84.8
ST-NBMIM [25]	2018	80.0	84.2
MTCNN [6]	2018	81.1	87.4
ST-GCN [26]	2018	81.5	88.3
DPRL+GCNN[24]	2018	83.5	89.8
SR-TSL [22]	2018	84.8	92.4
AS-GCN [10]	2019	86.8	94.2
2S-AGCN [20]	2019	88.5	95.1
DGNN [19]	2019	89.9	96.1
JT-MGCN(proposed)	**2019**	**90.40**	**95.78**

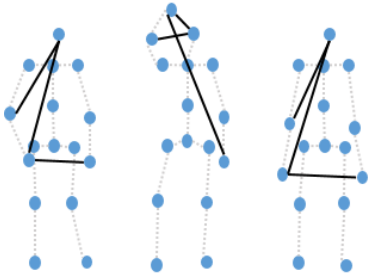
Results



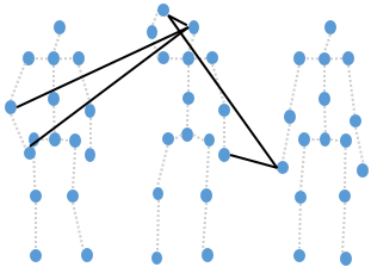
(a) Neighbor joint edge



(b) Neighbor temporal edge



(c) Distant joint edge



(d) Joint-temporal edge

	Method	CS(%)
Without shuffling	(a)+(b)+(c)	88.5
	(a)+(b)+(c)+(d)	90.4
With shuffling	(a)+(b)+(c)	13.4
	(a)+(b)+(c)+(d)	**8.8**

JT edges give More Meaningful features!

Results

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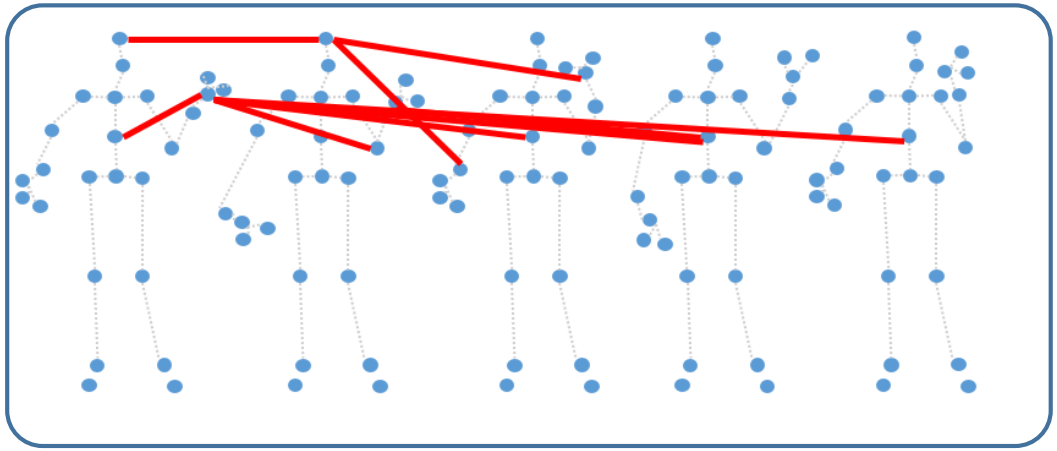
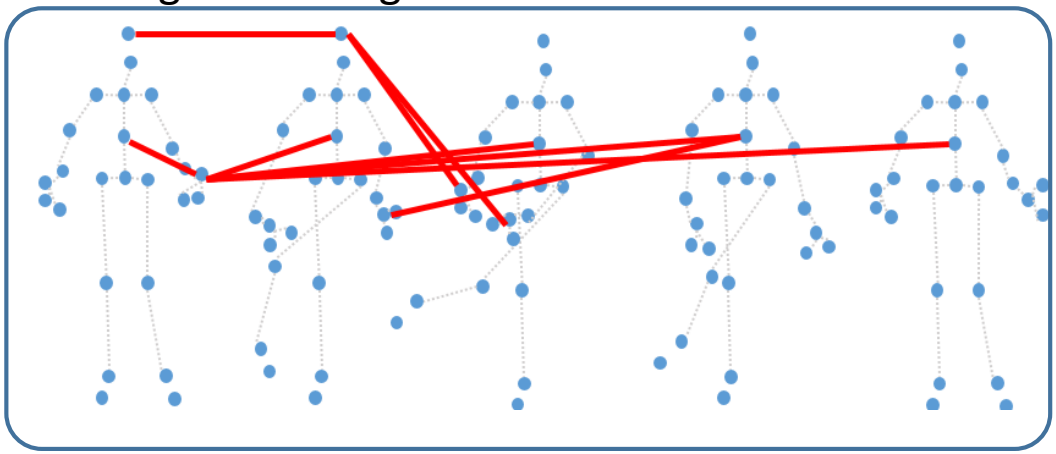
Visualization of Joint-Temporal edges

Drink water



Kicking Something



Independent edges are stronger than others!

Q & A