A Duplex Spatiotemporal Filtering Network for Video-based Person Re-identification

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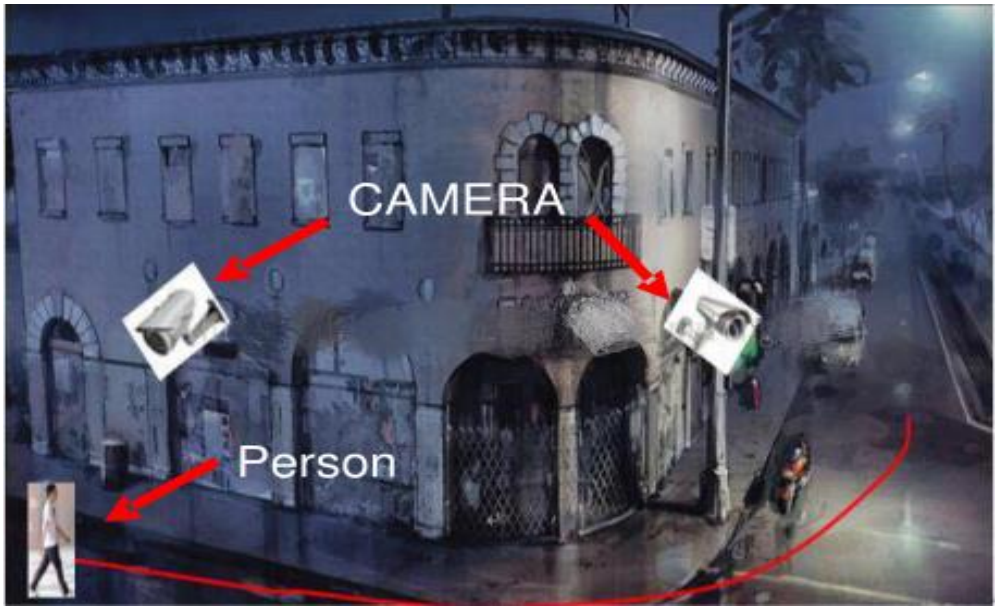
Problem

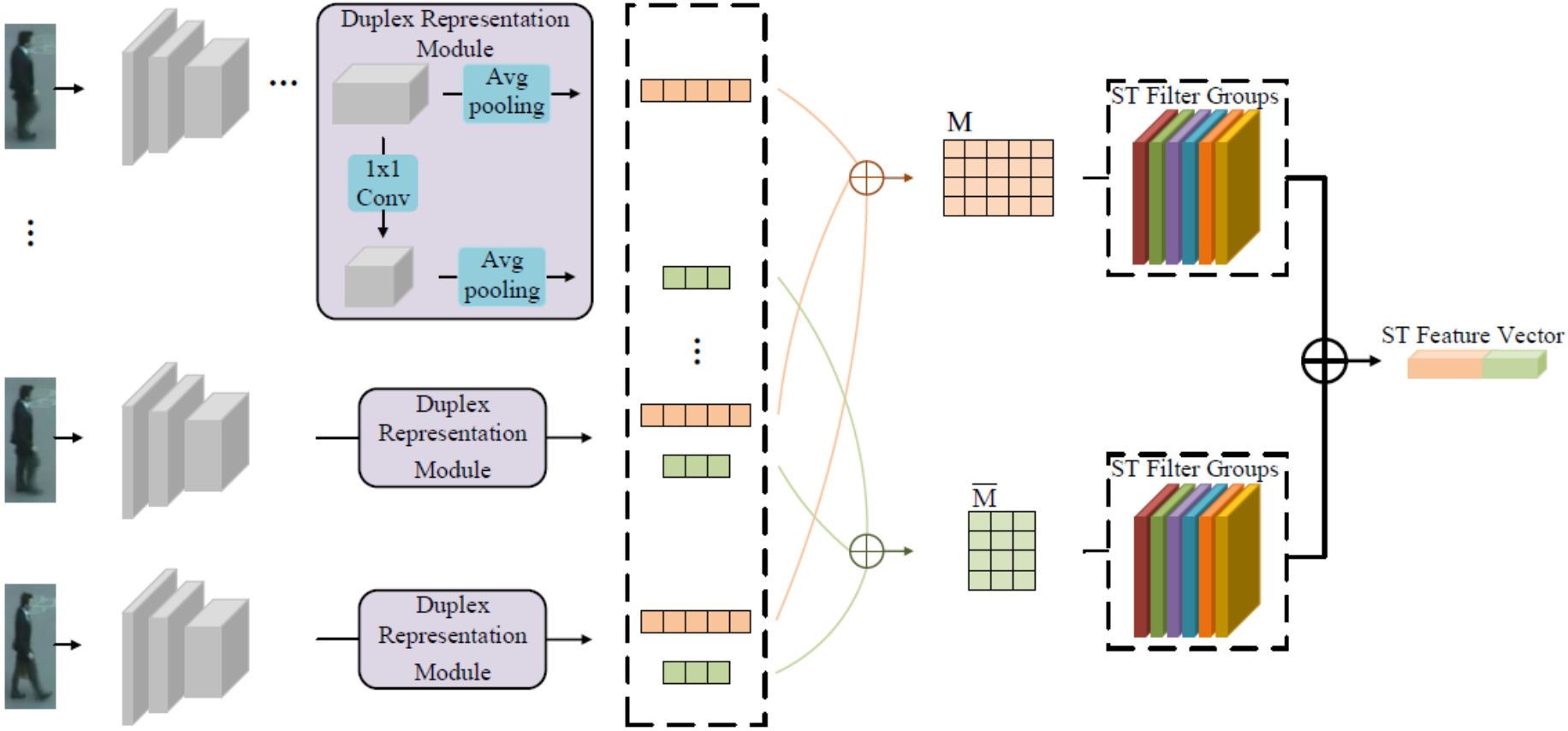


- **Definition:**

Person re-identification is a technology that uses computer vision technology to determine whether there is a specific pedestrian in an image or video sequence. Given a monitored pedestrian image, retrieve the pedestrian image under cross-devices.

Model

- Our model consists of 4 modules:
  1. Duplex representation module
  2. Spatial-temporal Feature Map
  3. Spatial-temporal Filters
  4. Sparse-Orthogonal Loss Function



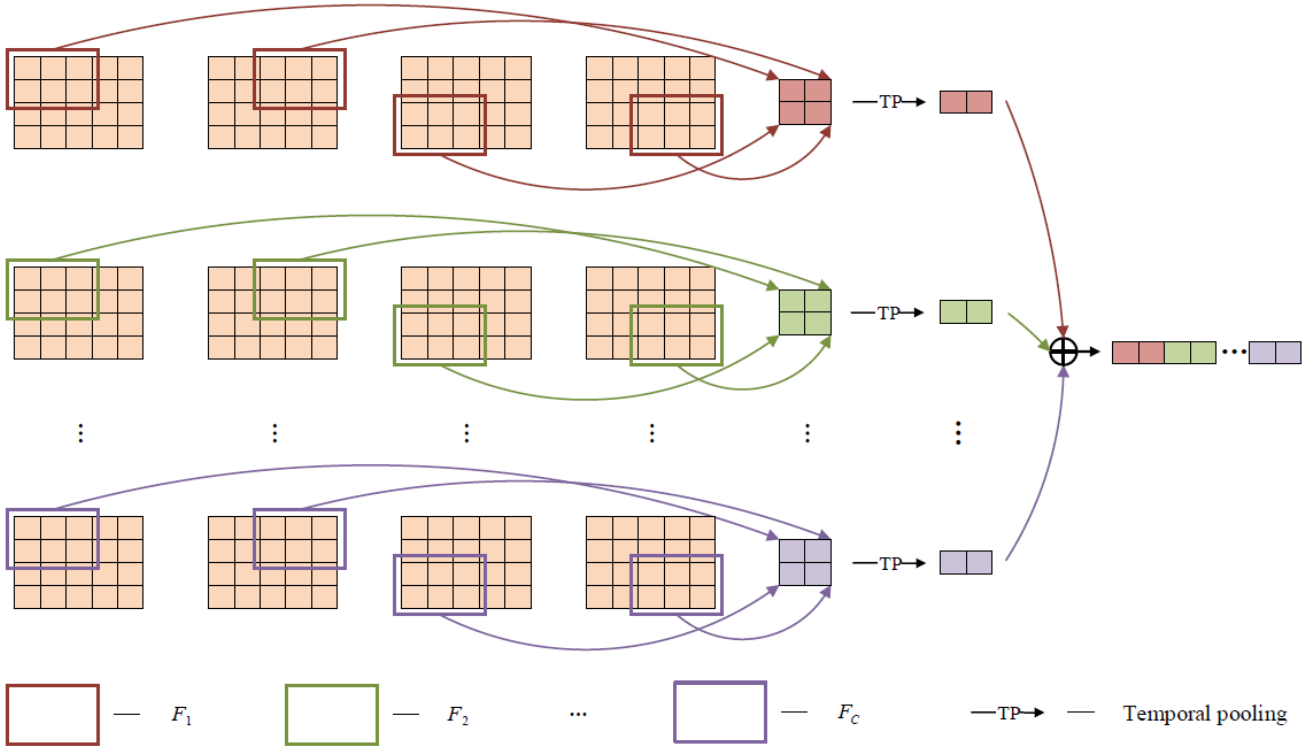
Model

Illustration of the filtering procedure:

We calculate the spatial-temporal features by

$$M_{F_h}(x,y) = \sum_{t=0}^{T-1}\sum_{s=0}^{S-1} M(xL_t + t, yL_s + s)F_h(t+1, s+1)$$

And the process can be represented by the following figure



Loss Function

- Orthogonal limitation between spatial filter groups:

$$L_O = \frac{1}{Q}\sum_{i=1}^{H}\sum_{j=1}^{W}\sum_{j'=1}^{W} P(F_{i,j}, F_{i,j'})$$

- Sparse limitation between temporal filter groups:

$$L_D = \frac{1}{Q}\sum_{i=1}^{H}\sum_{j=1}^{W}\sum_{j'=1}^{W} D(F_{i,j}, F_{i,j'})$$

- Sparse-Orthogonal Loss Function :

$$L_F = L_O - \alpha L_D$$

- Loss Function of the whole training process:

$$L = L_C + L_R + \beta L_F$$

Results & Ablation

Methods	rank-1	rank-5	rank-20
TDL[19]	56.7	80.0	93.6
MARS[23]	53.0	81.4	95.1
SeeForest[9]	79.4	94.4	99.3
QAN[30]	90.3	98.2	97.4
RQEN[31]	91.8	98.4	99.8
DRSA[10]	93.2	-	-
COSAM[7]	79.6	95.3	-
M3D[32]	94.4	**100.0**	-
snippet[12]	93.0	99.3	**100.0**
DSFN	**96.0**	98.7	99.7

1.PRID2011

Methods	rank-1	rank-5	rank-20
TDL[19]	56.3	87.6	98.3
MARS[23]	53.0	81.4	95.1
SeeForest[9]	55.2	86.5	97.0
QAN[30]	68.0	86.8	97.4
RQEN[31]	77.1	93.2	99.4
DRSA[10]	80.2	-	-
COSAM[7]	79.6	95.3	-
M3D[32]	74.0	94.3	-
snippet[12]	85.4	96.7	99.5
DSFN	**87.7**	**97.0**	**99.6**

2.iLIDS-VID

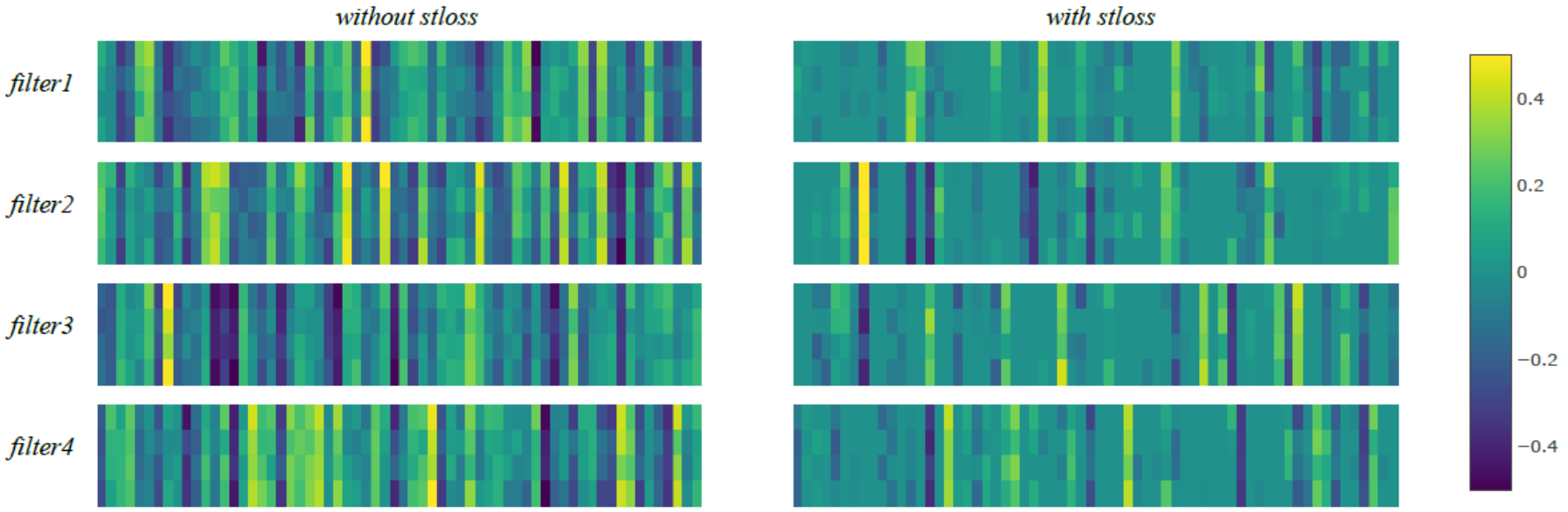
Methods	mAP	rank-1	rank-5	rank-20
MARS[23]	49.3	68.3	82.6	89.4
SeeForest[9]	-	70.6	90.0	97.6
QAN[30]	51.7	73.7	84.9	91.6
RQEN[31]	71.1	77.8	88.8	94.3
DRSA[10]	65.8	82.3	-	-
TriNet[22]	67.7	79.8	91.4	-
K-reciprocal[33]	68.5	73.9	-	-
M3D[32]	74.1	84.4	-	97.8
snippet[12]	76.1	86.3	94.7	**98.2**
COSAM[7]	**79.9**	84.9	95.5	98.0
DSFN	79.5	**86.6**	**95.8**	97.8
DSFN+Re-ranking	**87.4**	**87.8**	94.9	97.8

3.MARS

Dataset	iLIDS-VID		MARS	
Methods	rank-1	rank-5	mAP	rank-1
Baseline	84.5	96.5	78.3	84.8
STF	85.1	96.3	78.9	85.7
STF+DR	85.9	96.6	79.4	86.3
STF+DR+FC	**87.7**	**97.0**	**79.5**	**86.6**

Ablation experiment result

Visualization



After the spatial-temporal loss function is added to the training, more parameters of the filters are limited to 0, which realizes the sparse limitation of the loss function, so that different filter groups can focus on extracting different features

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Thanks for watching

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