HW9_report

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Results improvement

The results improved after combining the outputs.

Model	top1_acc	top5_acc	top10_acc
single_frame	0.779804	0.845096	0.850383
seq_3d	0.948454	0.968015	0.976209
combined	0.981232	0.989691	0.990484

Spatial information versus temporal information:

Highest performance

Following classes are predicted with 100% accuracy by single frame model but not 3d sequence model. Looking at static single frame is enough to tell the activity like 'PlayingFlute'. Hence, they are discriminated more by spatial information.

```
## [1] "SkyDiving"         "RockClimbingIndoor" "PlayingFlute"
## [4] "Surfing"           "BreastStroke"
```

Following classes are predicted with 100% accuracy by 3d sequence model but not single frame model. Looking at sequence of frames are helpful to better distinguish the activities like 'TableTennisShot'. Hence, they are discriminated more by temporal information.

```
##  [1] "VolleyballSpiking"  "BalanceBeam"         "TennisSwing"
##  [4] "TableTennisShot"    "Swing"               "SoccerPenalty"
##  [7] "TrampolineJumping"  "Rafting"             "FieldHockeyPenalty"
## [10] "Fencing"            "Drumming"            "HeadMassage"
## [13] "CleanAndJerk"       "HulaHoop"            "JumpingJack"
## [16] "JumpRope"           "ParallelBars"        "PlayingDhol"
## [19] "PlayingGuitar"      "PlayingPiano"        "PlayingViolin"
## [22] "Rowing"             "ApplyEyeMakeup"
```

Following classes are predicted with 100% accuracy by both 3d sequence model and single frame model.

```
##  [1] "BabyCrawling"    "BasketballDunk" "PlayingTabla"    "Diving"
##  [5] "HorseRace"       "HorseRiding"    "IceDancing"      "WritingOnBoard"
##  [9] "Bowling"         "Billiards"      "PoleVault"
```

Spatial information versus temporal information:

Lowest performance:

Following classes are in 10 lowest performance by single frame model but not 3d sequence model. Hence, they are discriminated more by temporal information.

```
## [1] "JumpRope"        "BodyWeightSquats" "PushUps"
## [4] "Shotput"         "JumpingJack"
```

Following classes are in 10 lowest performance by single frame model but not 3d sequence model. Hence, they are discriminated more by spatial information.

```
## [1] "BlowDryHair"     "CricketBowling" "Hammering"       "Lunges"
## [5] "Basketball"
```

Following classes are in 10 lowest performance by both single frame model and 3d sequence model.

```
## [1] "HandstandWalking" "FrontCrawl"       "HighJump"
## [4] "YoYo"             "Nunchucks"
```

Most confused classes

Most the confused classes include very similar activities. 'FrontCrawl' and 'BreastStroke' are especially confusing and they are the most confused classes for all three models. However, 'Hammering' and 'HeadMassage' are surprising since they are quite distinct actions.

Single-frame model

(top1_accuracy,top5_accuracy,top10_accuracy):

(0.779804,0.948454,0.981232)

10 classes with the highest performance:

All of the following classes have 100% accuracy.

```
##  [1] "Bowling"           "Diving"            "Billiards"
##  [4] "PoleVault"         "HorseRiding"       "HorseRace"
##  [7] "PlayingTabla"      "SkyDiving"         "IceDancing"
## [10] "BasketballDunk"    "WritingOnBoard"    "BabyCrawling"
## [13] "RockClimbingIndoor" "PlayingFlute"      "Surfing"
## [16] "BreastStroke"
```

10 classes with the lowest performance:

```
##  [1] "JumpRope"          "HandstandWalking" "BodyWeightSquats"
##  [4] "FrontCrawl"        "HighJump"          "YoYo"
##  [7] "Nunchucks"         "PushUps"           "Shotput"
## [10] "JumpingJack"
```

10 most confused classes.

true_label	prediction	off_diagonal_value
FrontCrawl	BreastStroke	0.5135
HighJump	JavelinThrow	0.3514
CricketShot	CricketBowling	0.3061
BodyWeightSquats	Lunges	0.3000
PushUps	BabyCrawling	0.3000
BrushingTeeth	ShavingBeard	0.2778
ApplyEyeMakeup	ApplyLipstick	0.2500
YoYo	JugglingBalls	0.2500
JumpingJack	JumpRope	0.2333
Hammering	HeadMassage	0.2162

3D Sequence model

(top1_accuracy,top5_accuracy,top10_accuracy):

(0.845096,0.968015,0.989691)

10 classes with the highest performance:

All of the following classes have 100% accuracy.

```
##  [1] "VolleyballSpiking"  "BabyCrawling"        "BalanceBeam"
##  [4] "TennisSwing"         "TableTennisShot"     "Swing"
##  [7] "SoccerPenalty"       "TrampolineJumping"   "BasketballDunk"
## [10] "PlayingTabla"        "Rafting"             "FieldHockeyPenalty"
## [13] "Fencing"             "Drumming"            "Diving"
## [16] "HeadMassage"         "CleanAndJerk"        "HorseRace"
## [19] "HorseRiding"         "HulaHoop"            "IceDancing"
## [22] "JumpingJack"         "JumpRope"            "WritingOnBoard"
## [25] "Bowling"             "ParallelBars"        "Billiards"
## [28] "PlayingDhol"         "PlayingGuitar"       "PlayingPiano"
## [31] "PlayingViolin"       "PoleVault"           "Rowing"
## [34] "ApplyEyeMakeup"
```

10 classes with the lowest performance:

```
##  [1] "HandstandWalking"  "Nunchucks"          "FrontCrawl"
##  [4] "BlowDryHair"        "HighJump"          "YoYo"
##  [7] "CricketBowling"     "Hammering"         "Lunges"
## [10] "Basketball"
```

10 most confused classes.

true_label	prediction	off_diagonal_value
FrontCrawl	BreastStroke	0.5676
BlowDryHair	Haircut	0.5263
BrushingTeeth	ApplyEyeMakeup	0.3611
YoYo	JugglingBalls	0.3611
Nunchucks	TaiChi	0.3143
Basketball	TennisSwing	0.2857
CricketShot	CricketBowling	0.2857
Kayaking	Rafting	0.2778
HammerThrow	ThrowDiscus	0.2444
HighJump	JavelinThrow	0.2432

Combined output of the two models

(top1_accuracy,top5_accuracy,top10_accuracy):

(0.850383,0.976209,0.990484)

10 classes with the highest performance:

All of the following classes have 100% accuracy.

```
##  [1] "Surfing"            "SoccerPenalty"     "FieldHockeyPenalty"
##  [4] "ParallelBars"       "Fencing"           "TennisSwing"
##  [7] "Drumming"           "Diving"            "VolleyballSpiking"
## [10] "BreastStroke"       "TableTennisShot"   "TrampolineJumping"
## [13] "Billiards"          "Bowling"           "WritingOnBoard"
## [16] "PlayingPiano"       "PlayingTabla"      "PlayingViolin"
## [19] "PoleVault"          "IceDancing"        "HulaHoop"
## [22] "HorseRiding"        "BabyCrawling"      "Rafting"
## [25] "RockClimbingIndoor" "Rowing"            "HorseRace"
## [28] "HeadMassage"        "BasketballDunk"    "Skijet"
## [31] "PlayingDhol"
```


10 classes with the lowest performance:

```
##  [1] "HandstandWalking" "FrontCrawl"        "HighJump"
##  [4] "Nunchucks"        "YoYo"             "CricketBowling"
##  [7] "Hammering"        "Lunges"           "BrushingTeeth"
## [10] "BodyWeightSquats"
```


10 most confused classes.

true_label	prediction	off_diagonal_value
FrontCrawl	BreastStroke	0.5676
BlowDryHair	Haircut	0.3421
HighJump	JavelinThrow	0.3243
Nunchucks	TaiChi	0.3143
Basketball	TennisSwing	0.2857
CricketShot	CricketBowling	0.2857
YoYo	JugglingBalls	0.2778
BoxingPunchingBag	BoxingSpeedBag	0.2653
BrushingTeeth	ShavingBeard	0.2500
Hammering	HeadMassage	0.2424