

## Part0 Accuracy of Training

	Training Accuracy (%)	Test Accuracy(%)
Single Frame Model	97.178947	73.594595
73.594594Sequence Model	98.752097	83.951271

## Part1 Top Accuracy

Results didn't improve after combining the outputs from two models. One possible explanation is that these two model learns different things thus on some videos, sequence model may perform better compared to the single frame model. So, the combined results(which is simply the unweighted average of results from two models) is worse than what sequence model learned.

Sequence model performed best since it combined the spatial information and temporal information. From the comparison, generally speaking, temporal information is also important when doing video classification.

	Top1 Accuracy	Top5 Accuracy	Top10 Accuracy
Single Frame Model	0.783505	0.944753	0.975945
Sequence Model	0.855406	0.973566	0.984668
Combine	0.800159	0.953740	0.979910

## Part2 Highest & Lowest Performance Classes

### 1. Single FrameModel

#### Highest Performance:

BabyCrawling, BasketballDunk, Billiards, Diving, MilitaryParade, PlayingFlute, PlayingTabla, PoleVault, RockClimbingIndoor, Rowing (All with probability 1)

#### Lowest Performance:

Class	JumpRope	YoYo	HandstandWalking	BodyWeightSquats	PizzaTossing
Probability	0.02631579	0.1388889	0.14705883	0.16666667	0.24242425
Class	Nunchucks	HighJump	JumpingJack	HandstandPushups	JavelinThrow
Probability	0.34285715	0.35135135	0.3783784	0.39285713	0.4516129

## 2. SequenceModel

### Highest Performance:

BasketballDunk, Billiards, Bowling, BoxingSpeedBag, CleanAndJerk, Diving, Drumming, Fencing, HeadMassage, HorseRace (All with probability 1)

### Lowest Performance:

Class Probability	Nunchucks 0.057142857	CricketBowling 0.3611111	CricketShot 0.40816328	Lunges 0.43243244	Hammering 0.4848485
Class Probability	HandstandWalking 0.5588235	PizzaTossing 0.57575756	YoYo 0.6111111	JavelinThrow 0.61290324	Basketball 0.62857145

## 3. Combine

### Highest Performance:

BabyCrawling, BasketballDunk, Billiards, Bowling, Diving, HorseRace, MilitaryParade, PlayingFlute, PlayingGuitar, PlayingTabla (All with probability 1)

### Lowest Performance:

Class Probability	JumpRope 0.05263158	YoYo 0.1428889	HandstandWalking 0.14705883	BodyWeightSquats 0.2	PizzaTossing 0.3030303
Class Probability	Nunchucks 0.34285715	HighJump 0.38125235	JumpingJack 0.45945945	SoccerJuggling 0.46153846	HandstandPushups 0.4642857

## 4. Observations

### Highest Performance:

The common classes in single frame model and sequence model is: **BasketballDunk, Billiards, Diving**. These three classes are characterized by certain background (can be distinguished by spatial information), that is why single frame model works well. Besides, If we look at the highest performance classes owned by each models respectively, single frame model tends to perform better on classes with typical spatial information, such as PlayingTabla and PlayingFlute. Meanwhile, sequence model tends to perform better on classes involved movement (e.g. Bowling, HorseRace CleanAndJerk and soon).

In the combine model, except for classes appeared in results of single frame model and sequence model, new class: **PlayingGuitar** appeared among the highest performance list. It is because distinguish PlayingGuitar needs both spatial and temporal information. In addition, **BabyCrawling, MilitaryParade, PlayingFlute** and **PlayingTabla** are only in the highest performance list of combined model and single frame model, so these action classes are discriminated more by spatial information verse temporal information.

### Lowest Performance:

For single frame model and sequence model, the common classes are: **YoYo, HandstandWalking, PizzaTossing, Numchunks, JavelinThrow**. For three models, common classes are: **YoYo, HandstandWalking, PizzaTossing, Numchunks**. It seems that sequence model performs bad when action classes is dominated by spatial information and single frame model performs bad when classification need more temporal information.

## Part 3 Most Confused Case

### 1. Single Frame Model

Class1	CricketShot	BrushingTeeth	YoYoJugglin	BodyWeightSquats	FrontCrawlBr
Class2	CricketBowling	ShavingBeard	gBalls	WallPushups	eastStroke
Probability	0.3469388	0.30555555	0.30555555	0.3	0.2972973
Class1		HighJumpJa	JumpRope	ApplyEyeMakeup	BenchPress
HaircutClass2		velinThrow0.	SalsaSpin	ApplyLipstick0.	Lunges
	BlowDryHair	27027026	0.2631579	25	0.25
Probability	0.27272728				

### 2. Sequence Model

Class1	CricketShot	FrontCrawl	BlowDryHair	Kayaking	Hammering
Class2	CricketBowling	BreastStroke	Haircut0.28	Rafting0.	HeadMassage
Probability	0.3469388	0.2972973	947368	2777778	0.27272728
Class1	Lunges	Nunchucks	YoYoJugglin	BoxingPunchingBag	HammerThrow
Class2	HandstandWalking	TaiChi0.25	gBalls0.25	BoxingSpeedBag0.	ThrowDiscus0.
Probability	0.27027026	714287		2244898	22222222

### 3. Combine

Class1	YoYo	CricketShot	BodyWeightSquats	FrontCrawl	BrushingTeeth
Class2	JugglingBalls	CricketBowling	WallPushups	BreastStroke	ShavingBeard
Probability	0.33333334	0.30612245	0.3	0.2972973	0.2777778
Class1	Haircut	HighJump	BoxingPunchingBag	JumpingJack	JumpRope
Class2	BlowDryHair	JavelinThrow	BoxingSpeedBag	JumpRope	SalsaSpin
Probability	0.27272728	0.27027026	0.24489796	0.24324325	0.23684211

### 4. Observations

Common confused action classes in three models above is: **YoYo – JugglingBalls and CricketShot – CricketBowling**. The reason for confusion is that the spatial information and temporal information of these two action classes are pretty similar. For YoYo-JugglingBalls, they are both round in shape and their movement involving rotating. Things are similar to CricketShot-CricketBowling.