

IE598 Deep Learning and Neural Networks

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HW3 : Action Recognition in Short Clips

The UCF-101 dataset consists of 13,320 videos belonging to 101 categories that are separated into 5 broad groups: Human-Object interaction (Applying eye makeup, brushing teeth, hammering, etc.), Body-Motion (Baby crawling, push ups, blowing candles, etc.), Human-Human interaction (Head massage, salsa spin, haircut, etc.), Playing Instruments (flute, guitar, piano, etc.) and Sports. This grouping allows us to separately study the performance improvements on Sports classes relative to classes from unrelated videos that are less numerous in our training data.

One important observation is that Convolutional Neural Networks learn more generic features on the bottom of the network (such as edges, local shapes) and more intricate, dataset-specific features near the top of the network. Since there is not enough data to train CNN from scratch, we resort to training only the top layers. The model takes up lots of memory (small batch size=slow training). We use a pre-trained network from ImageNet dataset to finetune it based on the UCF-101 data.

The training process saves features (dim 1024) for all frames in all videos. These are saved as .npy arrays. Besides the final output (prediction) for single frame evaluation is also stored. After converting the .npy arrays to hdf5 format for some speedup and post normalization, we calculate the accuracy based on the saved predictions.

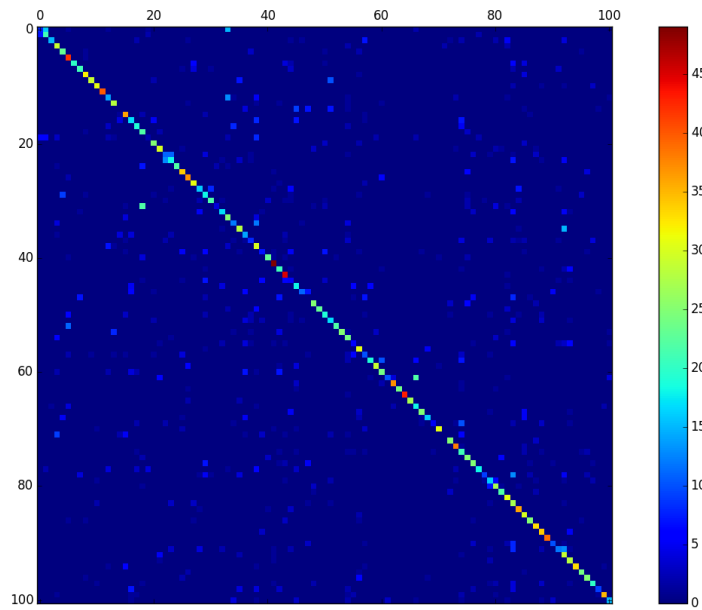
Accuracy

Top 1 : 0.598
Top 5 : 0.851
Top 10 : 0.921

The confusion matrix is uploaded here : <https://uofi.box.com/v/confusionmatrix>

The confusion matrix is also plotted here :

Figure 1: Confusion matrix for the 101 classes



Qualitative analysis from the confusion matrix reveals that some errors are from the most fine grained classes. Some of the most confused classes are mentioned in bold were (actual vs predicted) :

- **ApplyEyeMakeup** **ApplyLipstick**
- ApplyLipstick ApplyLipstick
- Archery Archery
- BabyCrawling BabyCrawling
- BalanceBeam BalanceBeam
- BandMarching BandMarching
- BaseballPitch BaseballPitch
- Basketball Basketball
- BasketballDunk BasketballDunk
- BenchPress BenchPress
- Biking Biking
- Billiards Billiards
- BlowDryHair BlowDryHair

- BlowingCandles BlowingCandles
- BodyWeightSquats JugglingBalls
- Bowling Bowling
- BoxingPunchingBag BoxingPunchingBag
- BoxingSpeedBag BoxingSpeedBag
- BreastStroke BreastStroke
- **BrushingTeeth HeadMassage**
- CleanAndJerk CleanAndJerk
- CliffDiving CliffDiving
- CricketBowling CricketBowling
- CricketShot CricketShot
- CuttingInKitchen CuttingInKitchen
- Diving Diving
- Drumming Drumming
- Fencing Fencing
- FieldHockeyPenalty FieldHockeyPenalty
- FloorGymnastics FloorGymnastics
- FrisbeeCatch FrisbeeCatch
- FrontCrawl BreastStroke
- GolfSwing GolfSwing
- Haircut Haircut
- Hammering Hammering
- HammerThrow HammerThrow
- HandstandPushups HandstandPushups
- HandstandWalking HandstandWalking
- HeadMassage HeadMassage
- HighJump HighJump
- HorseRace HorseRace
- HorseRiding HorseRiding
- HulaHoop HulaHoop
- IceDancing IceDancing
- **JavelinThrow FloorGymnastics**

- JugglingBalls JugglingBalls
- JumpingJack JumpingJack
- **JumpRope SoccerJuggling**
- Kayaking Kayaking
- Knitting Knitting
- LongJump LongJump
- Lunges Lunges
- MilitaryParade MilitaryParade
- Mixing Mixing
- MoppingFloor MoppingFloor
- Nunchucks Nunchucks
- ParallelBars ParallelBars
- PizzaTossing PizzaTossing
- PlayingCello PlayingCello
- PlayingDaf PlayingDaf
- PlayingDhol PlayingDhol
- PlayingFlute PlayingViolin
- PlayingGuitar PlayingGuitar
- PlayingPiano PlayingPiano
- PlayingSitar PlayingSitar
- PlayingTabla PlayingTabla
- PlayingViolin PlayingViolin
- PoleVault PoleVault
- PommelHorse PommelHorse
- PullUps RopeClimbing
- Punch Punch
- PushUps BabyCrawling
- Rafting Rafting
- RockClimbingIndoor RockClimbingIndoor
- RopeClimbing RopeClimbing
- Rowing Rowing
- SalsaSpin SalsaSpin

- ShavingBeard ShavingBeard
- Shotput SoccerJuggling
- SkateBoarding SkateBoarding
- Skiing Skiing
- Skijet Skijet
- SkyDiving SkyDiving
- SoccerJuggling SoccerJuggling
- SoccerPenalty SoccerPenalty
- StillRings StillRings
- SumoWrestling SumoWrestling
- Surfing Surfing
- Swing Swing
- TableTennisShot TableTennisShot
- TaiChi TaiChi
- **TennisSwing ThrowDiscus**
- ThrowDiscus ThrowDiscus
- TrampolineJumping TrampolineJumping
- Typing Typing
- UnevenBars UnevenBars
- VolleyballSpiking VolleyballSpiking
- WalkingWithDog WalkingWithDog
- WallPushups WallPushups
- WritingOnBoard WritingOnBoard
- YoYo YoYo