CS4243 MINI PROJECT

IMAGE CLASSIFICATION WITH MACHINE LEARNING

ABSTRACT

Modifying the loss function of a classification Convolutional Neural Network(CNN) to minimize false positives of a particular class.
Normal: Weapon not present Carrying: Weapon being held Threat: Weapon being used

INITIAL APPROACH W BASELINE MODEL

PARAMETERS

- Pretrained Model: Resnet18
- Batch Size: 256
- Epoch: 15
- Dropout: 0.1
- Optimizer: Adam

Description

- Basic data processing and split data into training and testing
- Use pretrained resnet18 and fine tuned model
- Apply dropout due to small dataset

OBSERVATION:

- High False positives for Normal Class ,
- High False negatives for Threat Class.

Not good as a Threat/Carrying class could be overlooked

RESULTS

		ACTUAL		
		NORMAL	CARRYING	THREAT
PREDICTED	NORMAL	295	71	52
	CARRYING	8	192	18
	THREAT	8	18	228

	PRECISION	RECALL	F1
NORMAL	0.706	0.949	0.809
CARRYING	0.881	0.683	0.770
THREAT	0.898	0.765	0.826
ACCURACY			0.803377

MODIFIED APPROACH

Motivation

- Reduce the number of false positives in Normal Class
- Evaluation of results

Modification

- Modified cross entropy loss to increase total loss when prediction value of Normal is high but actual result is Carrying or Threat

```
def modified_loss(preds, targets):
  def log_softmax(x):
    return x - torch.logsumexp(x,dim=1, keepdim=True)
  num_examples = targets.shape[0]
  batch_size = preds.shape[0]
  outputs = log_softmax(preds)
  for x in range(len(outputs)):
    factor = (0.9+(1-preds[x,0].item())/10)
    outputs[x,1] = outputs[x,1]*factor
    outputs[x,2] = outputs[x,2]*factor
  outputs = outputs[range(batch_size), targets]
  return - torch.sum(outputs)/num_examples
```

FINAL RESULTS

		ACTUAL		
		NORMAL	CARRYING	THREAT
PREDICTED	NORMAL	268	25	30
	CARRYING	28	245	53
	THREAT	15	11	215

	PRECISION	RECALL	F1
NORMAL	0.830	0.862	0.845
CARRYING	0.751	0.872	0.807
THREAT	0.892	0.721	0.798
ACCURACY			0.81797

OBSERVATION:

False positives for Normal Class decreases, overall accuracy increases.
Detection of Carrying class improves although Threat class detection had decreased

CONCLUSION:

Our group chose this approach to minise the false positives of the Normal Class because in this scenario, it is important for the false positives of the Normal Class to be low in the case there is a real threat in the image.

Contributions

Leong En Ze Hope - Developed Machine Learning baseline model and modified model
Wong Kok Ian - Training and testing of model
Chan Wa Wai - Modified approach
Bryan Beh Wah Jun - Compile data and analysis with design of poster