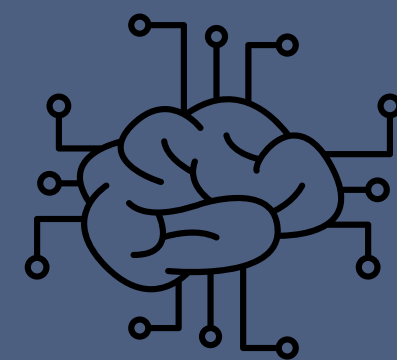


CS4243 MINI PROJECT

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

PREDICTED	ACTUAL			
		NORMAL	CARRYING	THREAT
	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
```

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

FINAL RESULTS

PREDICTED	ACTUAL			
		NORMAL	CARRYING	THREAT
	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 minimise 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.