Implementation Details

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Method

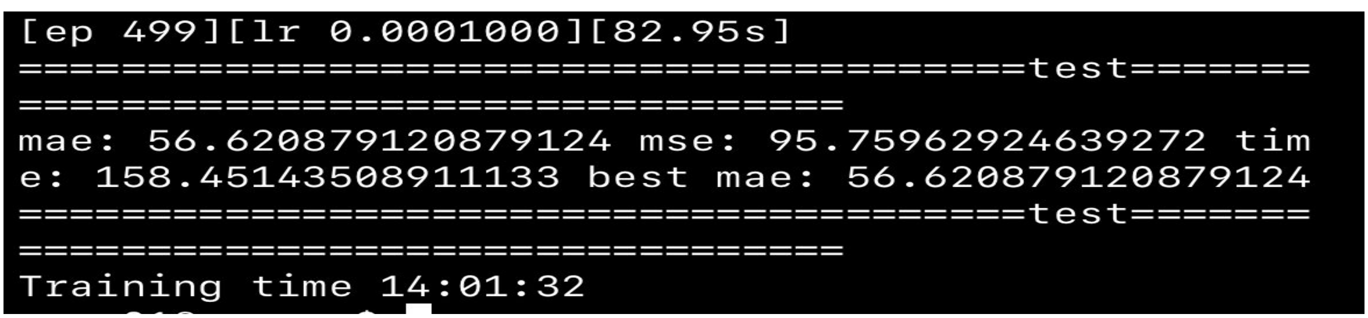
To implement **Adaptive Point Dropout During Training**, we randomly drop a few crowd ground truth points from point annotations based on density map during each training iteration in dense areas to encourage the model to generalize and handle missing information better .This method reduces the model's dependency on exact point locations, Adaptive point dropout helps the model learn patterns rather than memorize specific configurations.This can mitigate overfitting where the model rely on specific points rather than generalizing to crowd usually in dense areas.

I added the function “‘gaussian_point_dropout“‘and “‘get_gaussian_densities“‘ in **SHHA.py** present inside **crowd_datasets/SHHA** directory to dropout ground truth points from annotations based on gaussian densities we get from function “‘get_gaussian_densities“‘.

Evaluation

For the Dataset SHTech Part A model is trained for 500 epochs got MAE score of 56.62 and MSE score of 95.75 which is significantly close to mentioned score in paper which is obtained by running 3500 epochs and mae score is better than phase 1 due to adaptive dropout technique. Therefore, if having sufficient resources and running model for 3500 epochs it can easily approach the mentioned scores.

SHTech Part A Dataset	Mentioned Scores	Obtained Scores	Approximated Scores
MAE Score	52.74	56.62 (500 epochs)	can easily match (in 3500 epoch)
MSE Score	85.06	95.72 (500 epochs)	can easily match (in 3500 epoch)



```
[ep 499][lr 0.0001000][82.95s]
========================================test=======
==============================
mae: 56.620879120879124 mse: 95.75962924639272 tim
e: 158.45143508911133 best mae: 56.620879120879124
========================================test=======
==============================
Training time 14:01:32
```

Screenshot of obtained values after running

For the Dataset SHTech Part B model is trained for 500 epochs which and got MAE score of 9.69 and MSE score of 16.70 which is significantly close to mentioned score in paper which is obtained by running 3500 epochs. Therefore, if having sufficient resources and running model for 3500 epochs it can easily approach the mentioned scores.

SHTech Part B Dataset	Mentioned Scores	Obtained Scores	Approximated Scores
MAE Score	6.25	9.69 (500 epochs)	can easily match (in 3500 epoch)
MSE Score	9.9	16.70 (500 epochs)	can easily match (in 3500 epoch)

```
Averaged stats: lr: 0.000100  loss: 0.0027 (0.0033
)  loss_ce: 0.0027 (0.0033)  loss_ce_unscaled: 0.0
027 (0.0033)  loss_point_unscaled: 30.3323 (32.456
2)
[ep 499][lr 0.0001000][70.32s]
=======================================test=======
======================================
mae: 9.699367088607595 mse: 16.70774473641536 time
: 367.52195954322815 best mae: 9.389240506329115
=======================================test=======
======================================
Training time 10:52:38
```

Screenshot of obtained values after running

Overall there is improvement in MAE score but MSE score is slightly increased because Mean Absolute Error (MAE) measures the average magnitude of errors without considering their direction so, it is more robust to individual outliers whereas Mean Squared Error (MSE) squares each error giving more weight to larger errors.
With Adaptive Point Dropout, the model generalize better to typical patterns (hence improving MAE) but may occasionally make larger errors in denser regions where points are dropped which impacts the MSE score. The squared nature of MSE amplify these large errors making it more sensitive to regions where the model deviates significantly from the ground truth.

Citation

Github: `https://github.com/TencentYoutuResearch/CrowdCounting-P2PNet`
Paper: `https://arxiv.org/abs/2107.12746`