

Article reviewed: Densely Connected Convolutional Networks – Meetu Malhotra

Reference: [1608.06993.pdf \(arxiv.org\)](https://arxiv.org/pdf/1608.06993.pdf)

Summary: In this manuscript, the authors introduced the concept of the Dense Convolutional Network (DenseNet). The key innovation of DenseNet lies in its interconnectedness, as it establishes direct connections between each layer and every other layer in a feed-forward manner. As opposed to conventional convolutional networks, where each of the L layers is connected only to its immediate subsequent layer, our network boasts $L(L+1)/2$ direct connections, with a high number of features. DenseNets offer numerous advantages, such as mitigating the vanishing-gradient issue, enhancing the propagation of features, promoting feature recycling, and significantly reducing the parameter count. The results in the paper have been tested on CIFAR-10, CIFAR-100, SVHN, and ImageNet datasets. The results showed significant improvements, that too with less computation.

Five C's:

Category: The paper falls under the category of Computer vision and pattern recognition

Context: The paper focuses on reducing error rate CIFAR-10, CIFAR-100, SVHN, and ImageNet datasets classification by implementing denseNets.

Correctness: The paper presents accurate information on developing denseNets framework as shown in the table 3 section, covering comparison on top-1 and top-5 results for different denseNets models, tuned on different layers.

Contributions: This paper significantly changed the domain of deep learning, especially in computer vision by introducing the concept of denseNets, neural networks implementing direct connections between any two layers with the same feature-map size. It addressed the vanishing gradient problem. The paper also focuses on scaling capability of densenets to 100s of layers, without compromising the accuracy. It showed significant improvement top-1 and top-5 error rate on all 4 datasets with different layered sdensenets models.

Clarity: The paper is written in a clear and understandable manner. It starts with the introduction of denseNets and then results of top-1 and top-5 error rate comparison on different denseNets models

Outline: The paper follows a logical structure, starting with an introduction of DenseNets, how are they different from CNNs in layers connection. It then talks about its architecture as shown in table 1, concept of denseNets, pooling, growth rate and the implementation. It then shows fair comparison of densenets with different hyperparameters on all 4 datasets used for experiments. Lastly it covers the future scope of densenets that they can be implemented to extract features in convolutional setting.

Discussion:

Innovations: It brought the innovative idea of direct connections between each layer and every other layer in a feed-forward manner. This helps in reducing feature, high computational power, without issues in vanishing gradients and overfitting.

Assumptions: The paper assumes that the readers have fundamental understanding of neural network concepts such as deep neural networks.

Faults: As discussed in Conclusion section 6 of the paper, the limitation of paper includes not working on computer vision tasks that build on convolutional features, where feature extraction using denseNets can be done in future. More effort in hyperparameter tuning, might yield better results.

Terminology: DenseNets, Deep learning CNNs, Stochastic and deterministic connections, Deep supervision, ImageNet classification, object recognition, feature maps