



Module 2: Building Blocks for Image Recognition

Video 10: DenseNet + Hands on

In Air

DenseNet

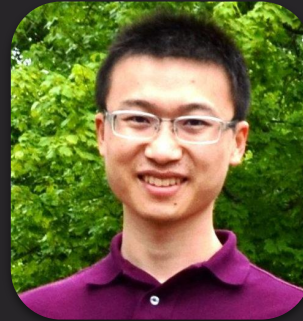
- DenseNet, developed in 2017, promotes feature reuse and alleviate vanishing gradient problem.



Laurens van



Zhuang Liu



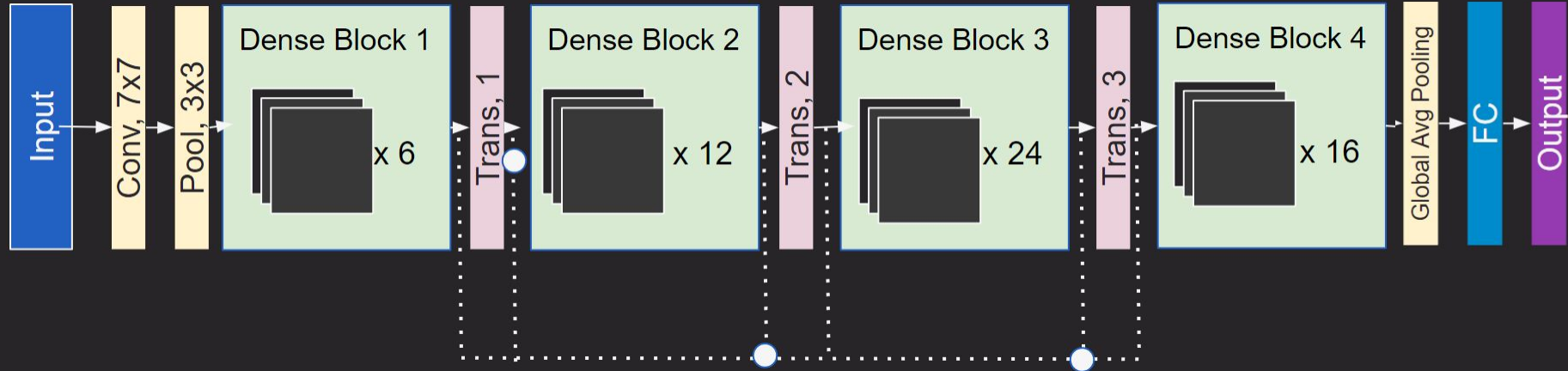
Gao Huang



Killian Q

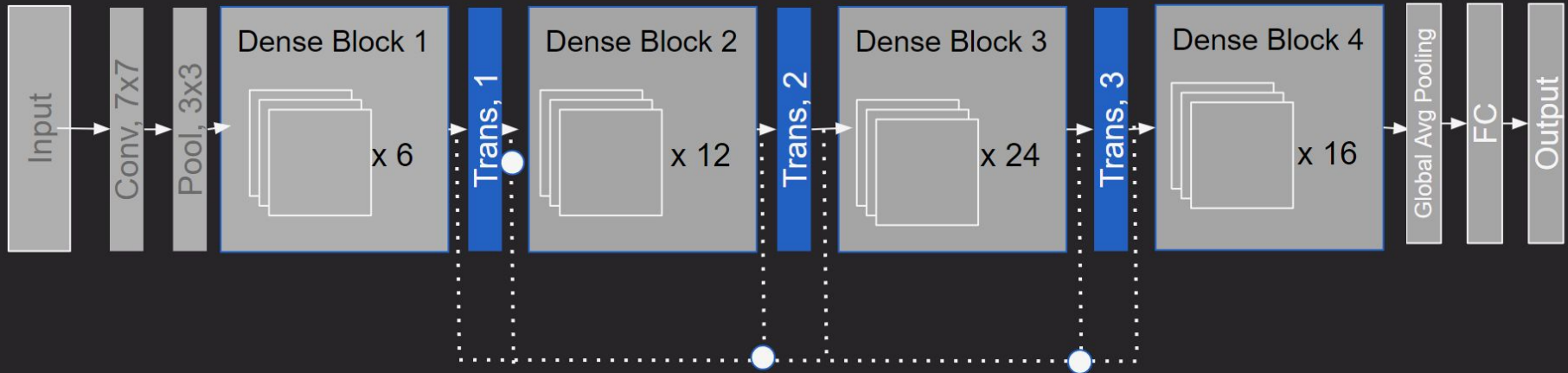
DenseNet 121

- Contains 4 Dense Blocks, each containing multiple convolutional layers.



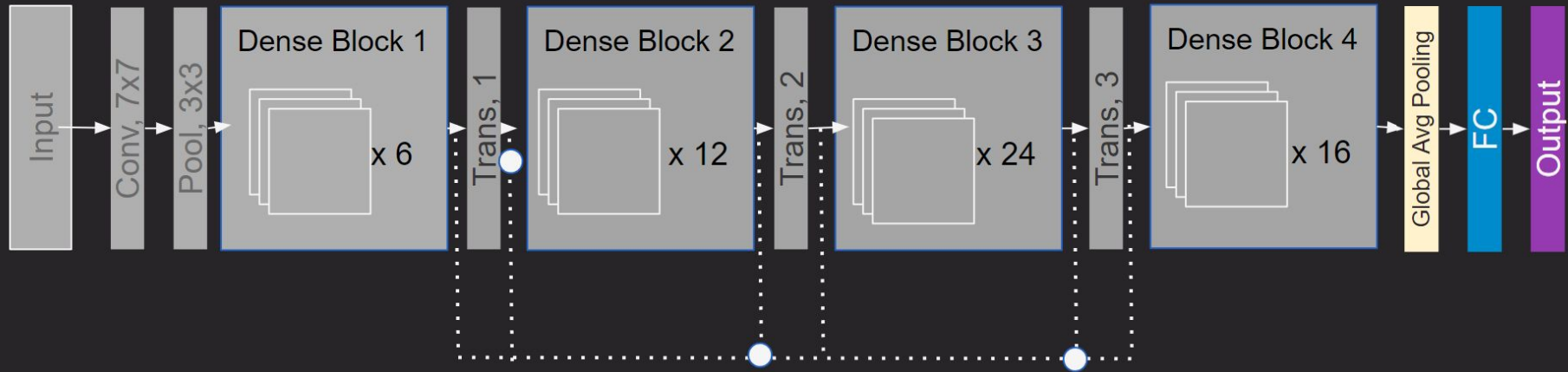
DenseNet 121

- **Transition Layers:** Includes convolution and Pooling Operations; reduces spatial dimensions.

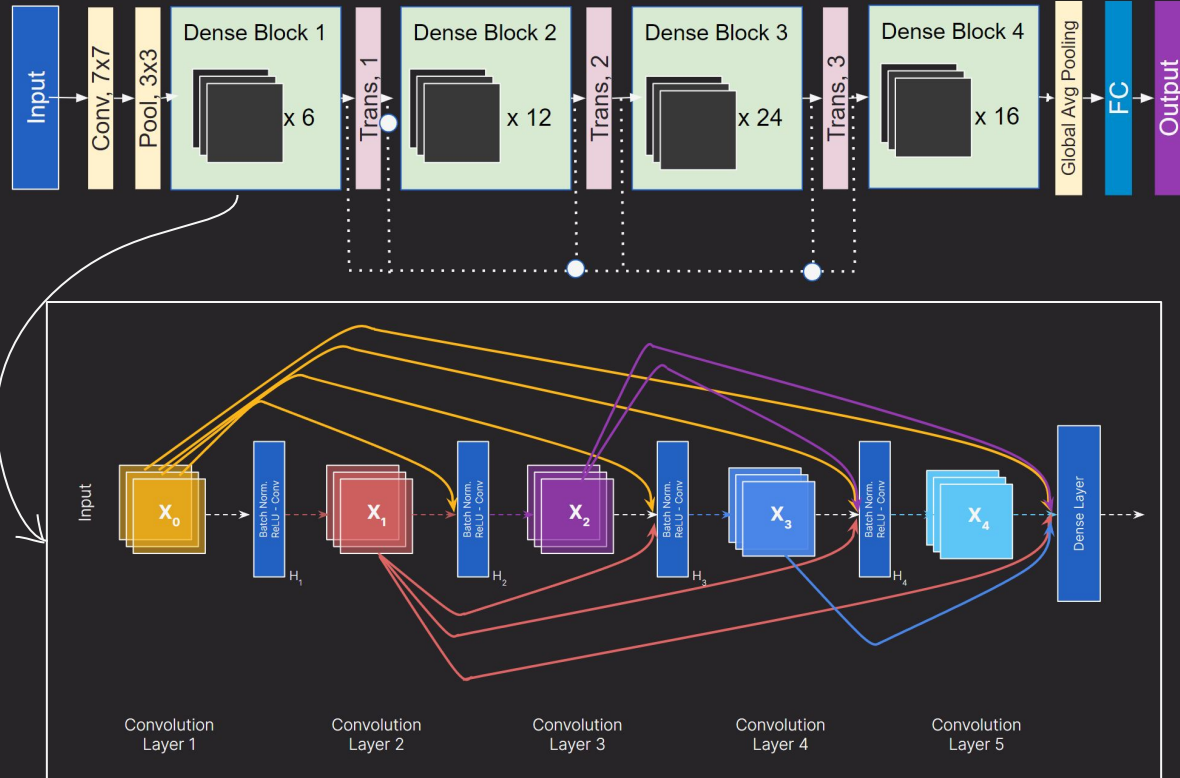


DenseNet 121

- Utilize parameter sharing extensively.
- Reuse features from previous layers & minimizes the number of parameters needed.

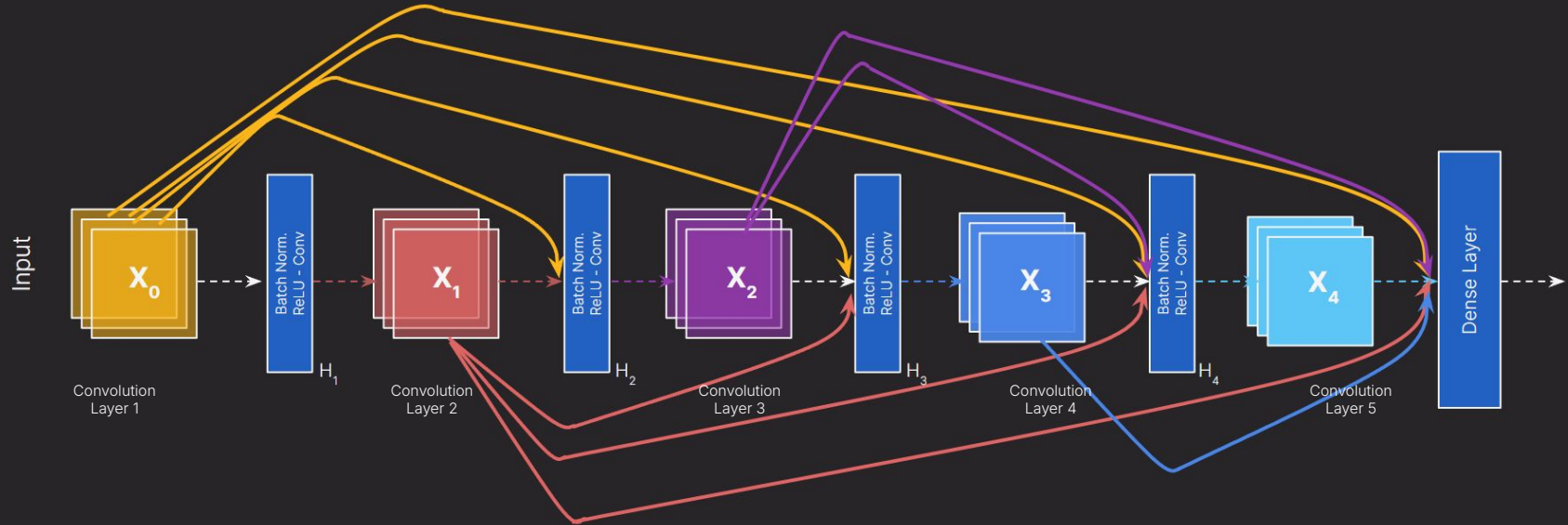


Dense Block

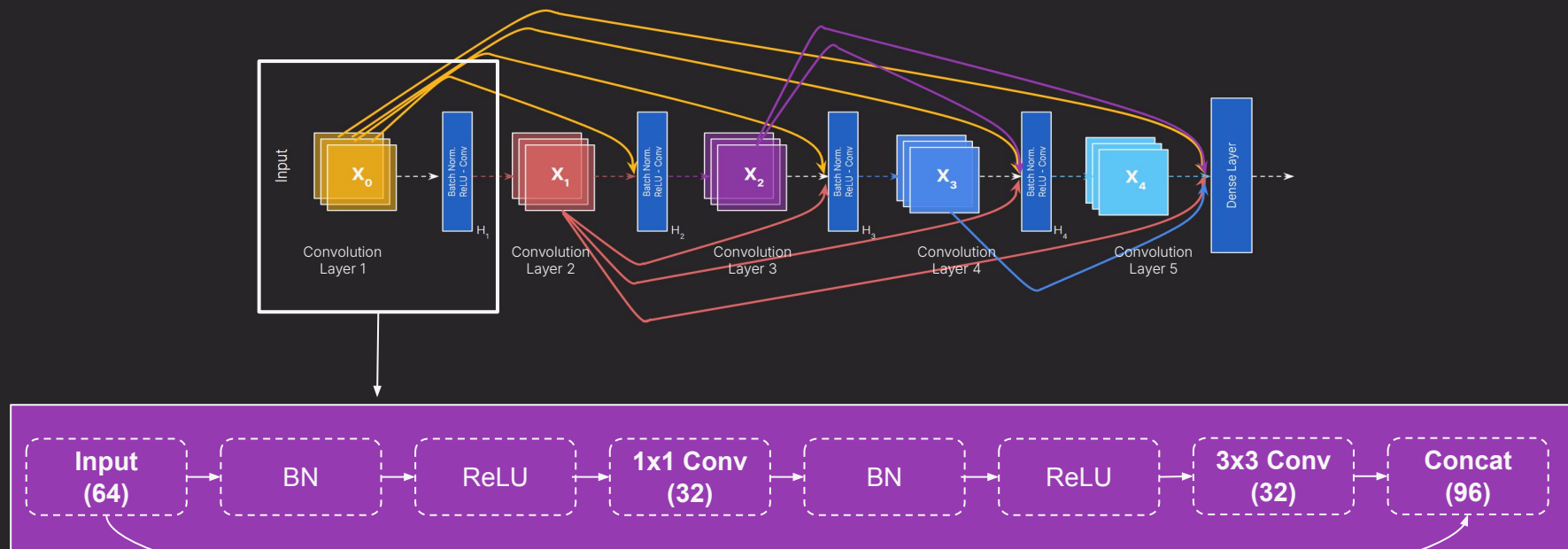


DenseNet

- **Dense Blocks** consists multiple convolutional layers densely connected to each other.
- Layers inherit outputs from all previous layers in the block.



DenseNet



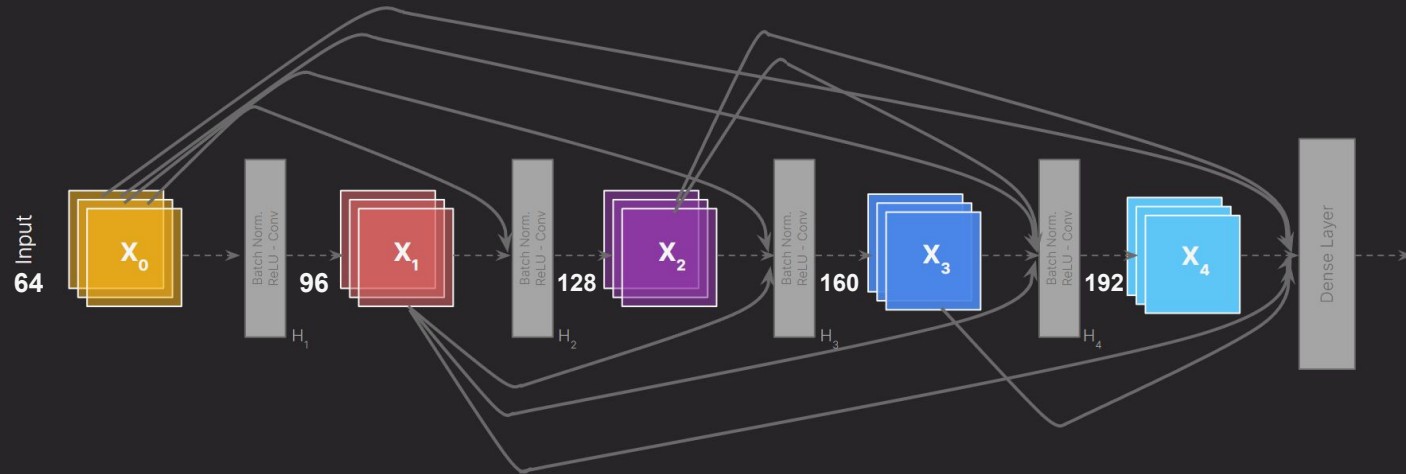
Growth Rate

Layer 1:

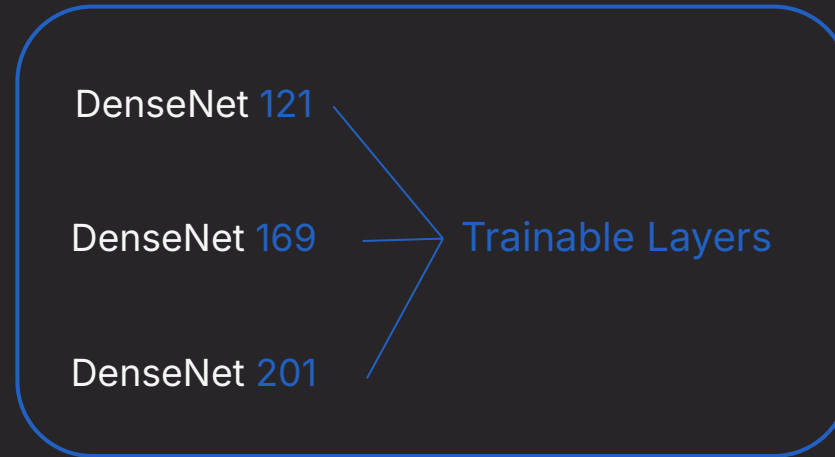
- Input Feature Maps: 64
- Growth Rate: 32
- Output Feature Maps: 96 (64 input + 32 new)

Layer 2:

- Input Feature Maps: 96
- Growth Rate: 32
- Output Feature Maps: 128 (96 input + 32 new)



Common DenseNet Configurations



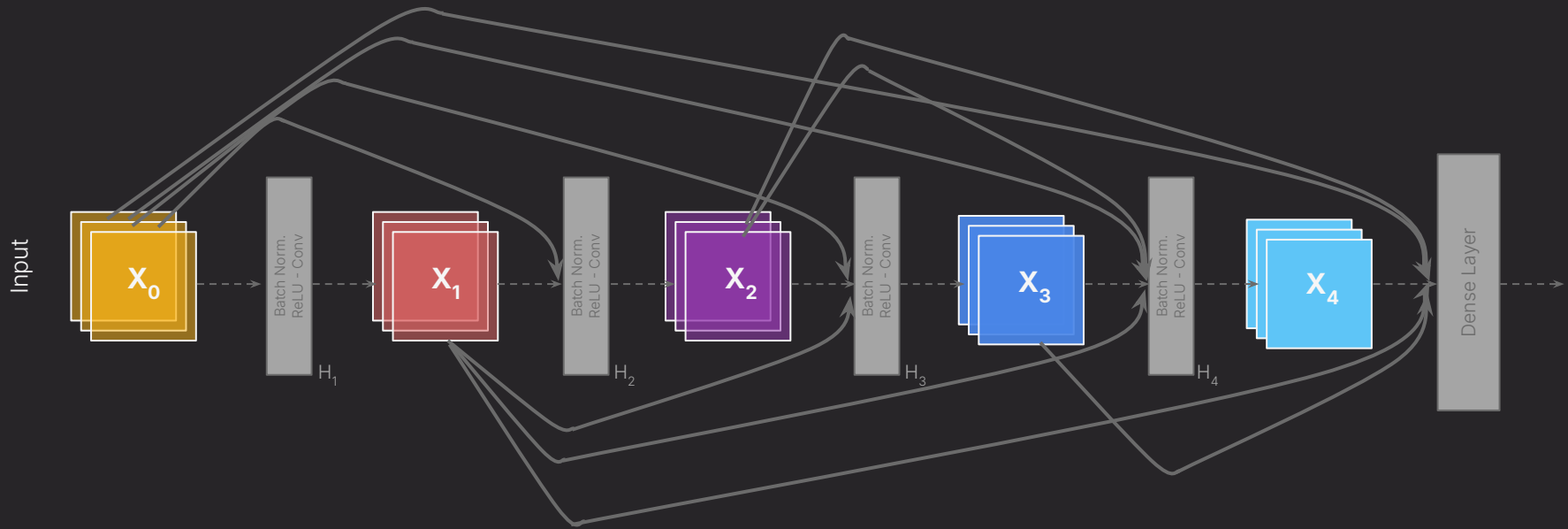
DenseNet 121 On ImageNet

Model	Size (MB)	Top-1 Accuracy	Top-5 Accuracy	Parameters	Depth	Time (ms) per inference step (CPU)	Time (ms) per inference step (GPU)
ResNet50	98	74.9%	92.1%	25.6M	107	58.2	4.6
ResNet50V2	98	76.0%	93.0%	25.6M	103	45.6	4.4
ResNet101	171	76.4%	92.8%	44.7M	209	89.6	5.2
ResNet101V2	171	77.2%	93.8%	44.7M	205	72.7	5.4
ResNet152	232	76.6%	93.1%	60.4M	311	127.4	6.5
ResNet152V2	232	78.0%	94.2%	60.4M	307	107.5	6.6
DenseNet121	33	75.0%	92.3%	8.1M	242	77.1	5.4
DenseNet169	57	76.2%	93.2%	14.3M	338	96.4	6.3
DenseNet201	80	77.3%	93.6%	20.2M	402	127.2	6.7

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UpNext: Hands-on



Dense Block

