



## Module 2: Building Blocks for Image Recognition

### Video 9: ResNet + Hands-on

In Air

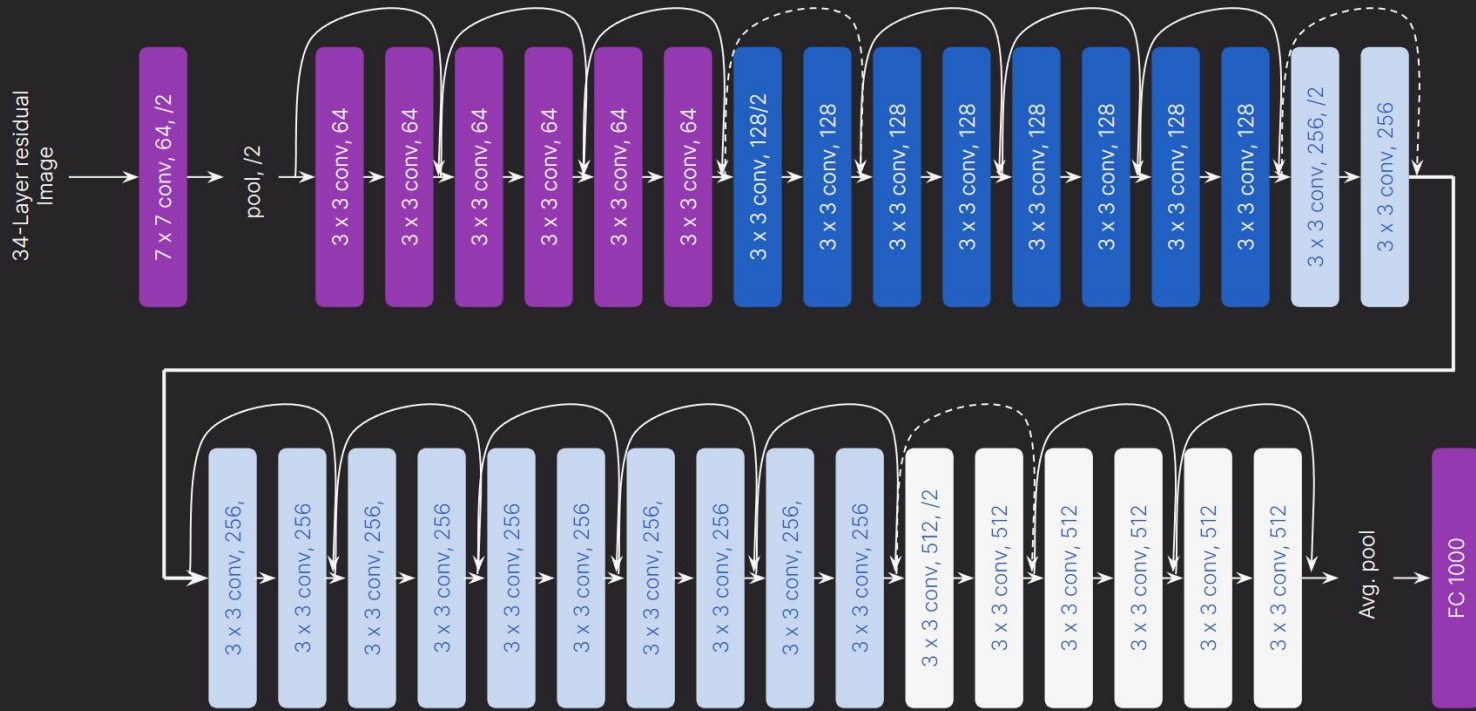
# ResNet

- ResNet is also called as **Residual Network**, tackles vanishing gradient problem.



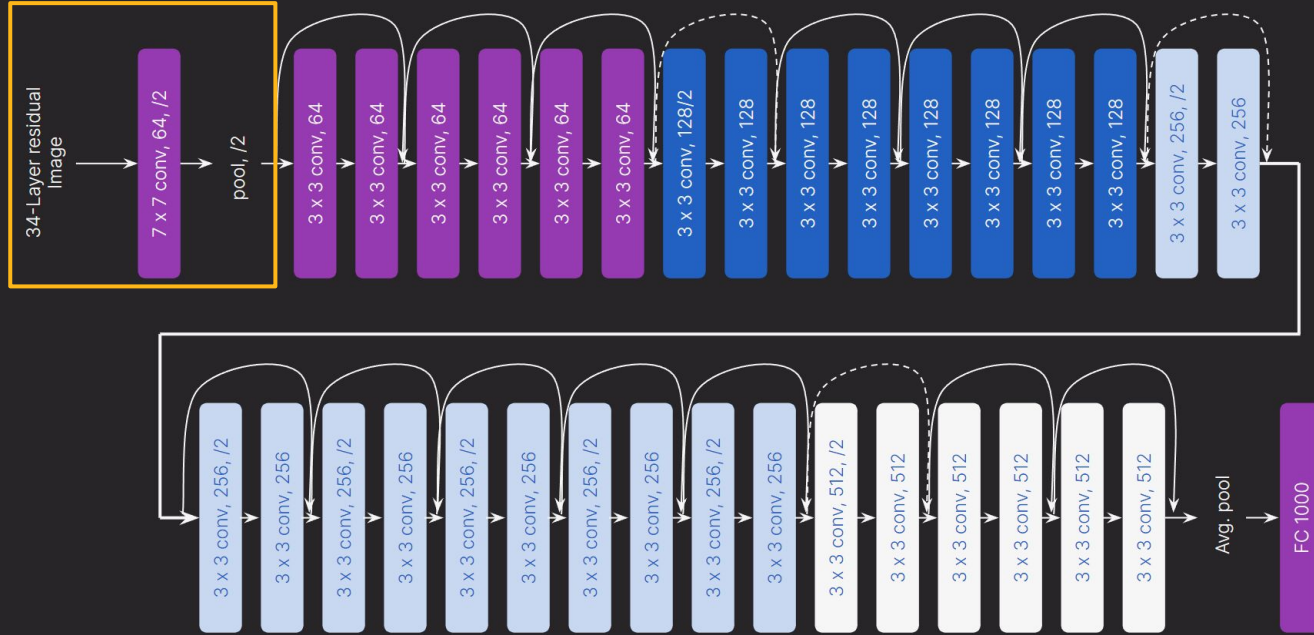
Kaiming He

# ResNet 34



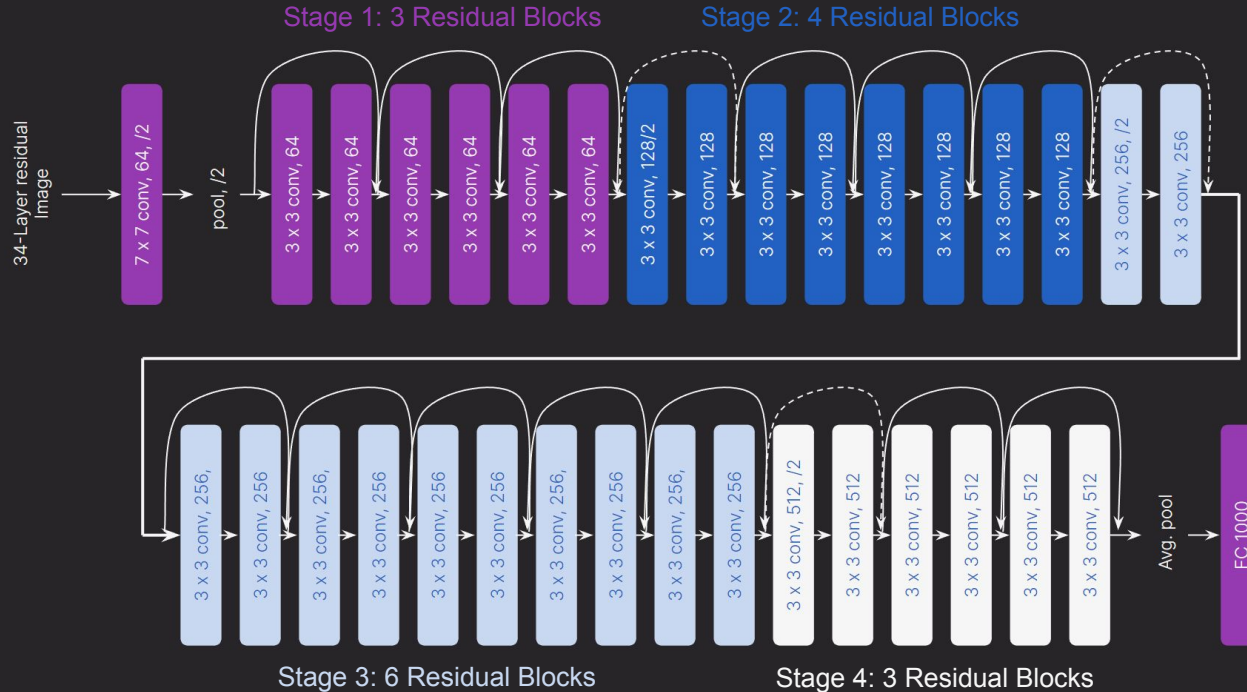
# ResNet 34

- Initial Layers: 7×7 Convolution, 3×3 Max Pooling.



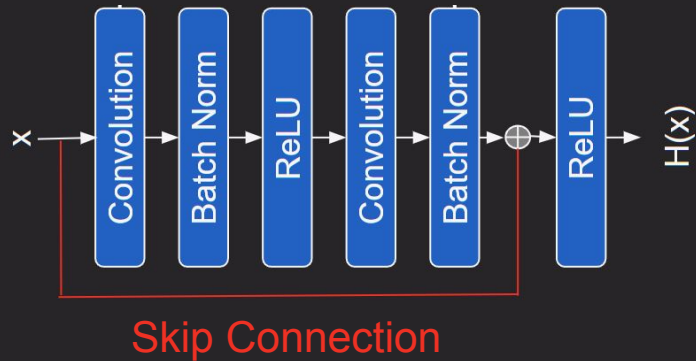
# ResNet 34

- 4 main stages with different number residual blocks and convolutional layers.



# ResNet 34

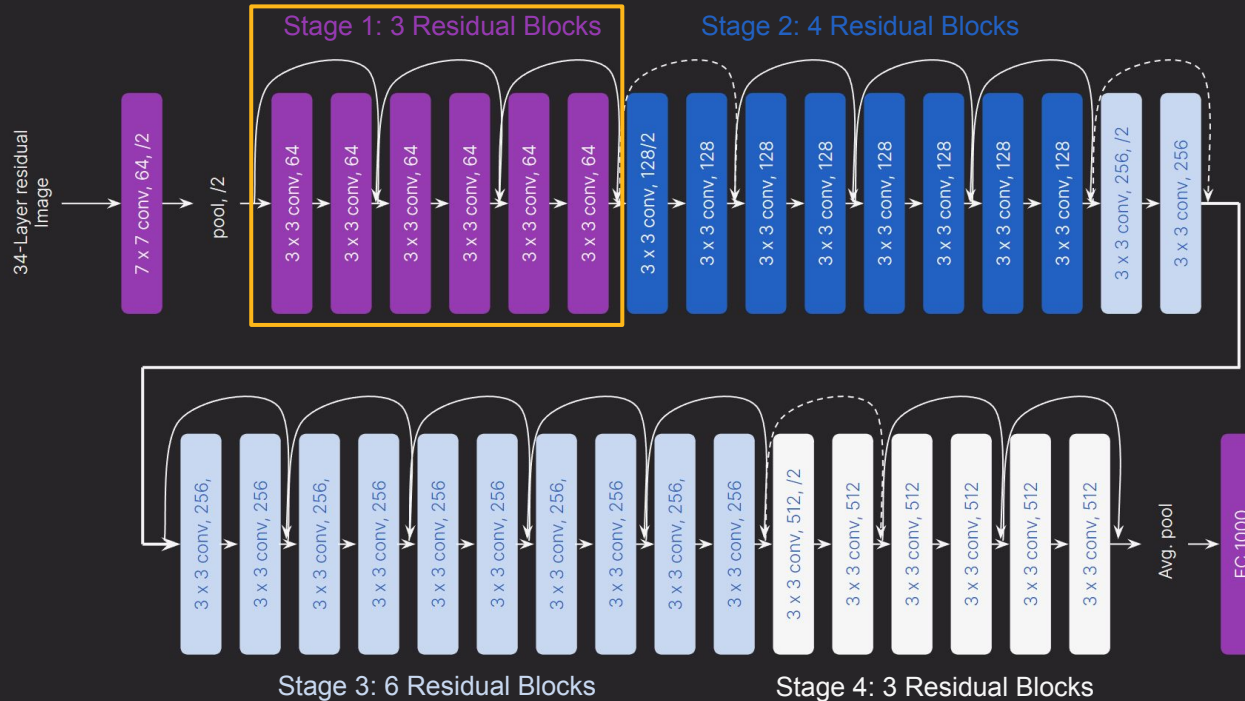
- **Skip Connections:** Adds the input of the block directly to its output.



Mitigating Vanishing Gradient

# ResNet 34

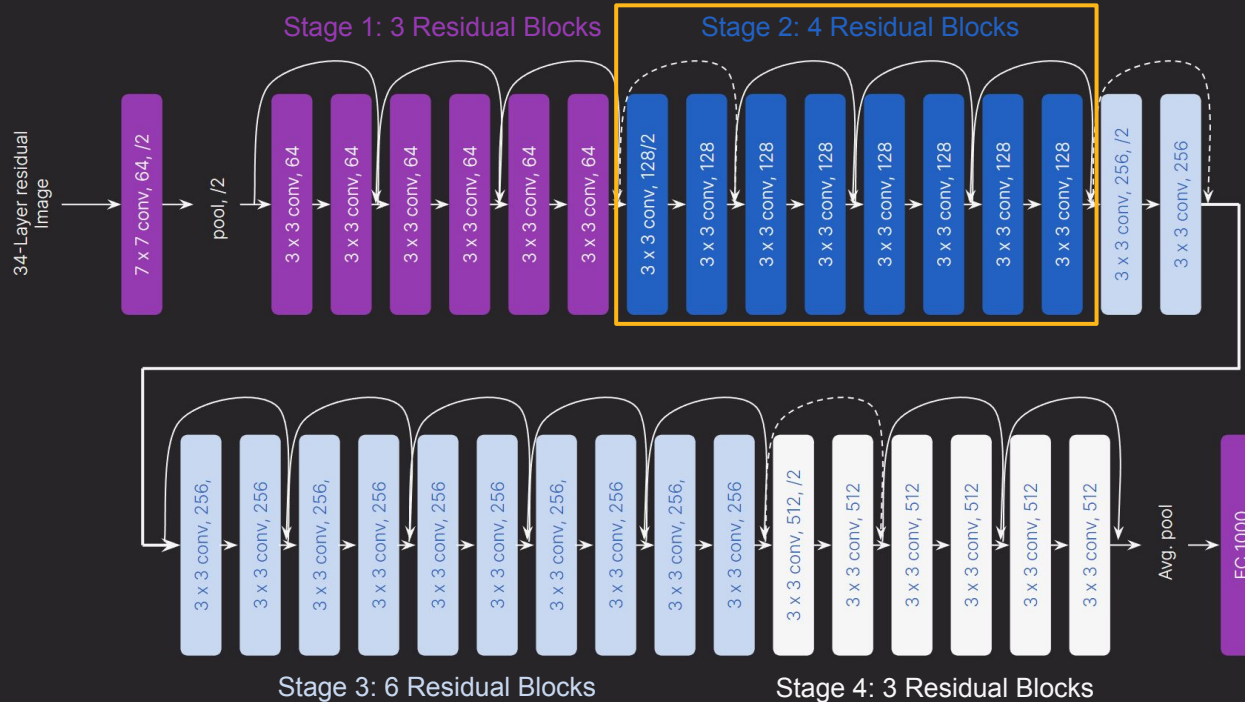
- Residual Blocks





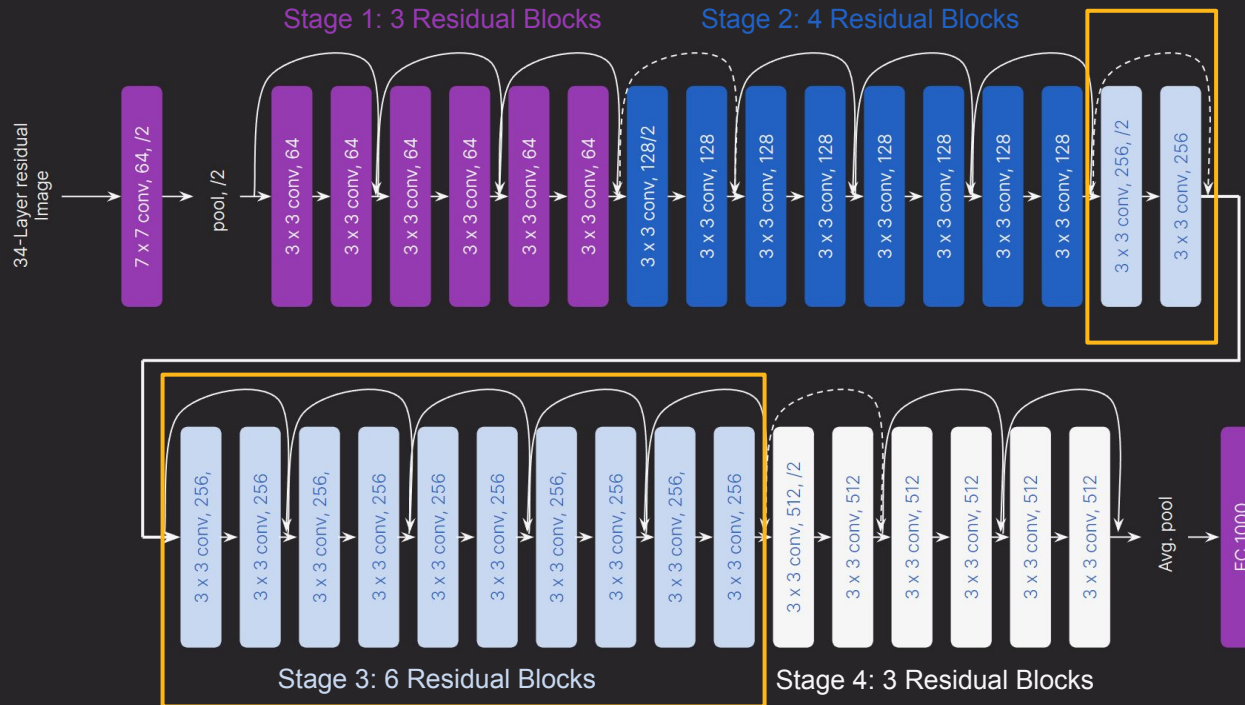
# ResNet 34

- Residual Blocks



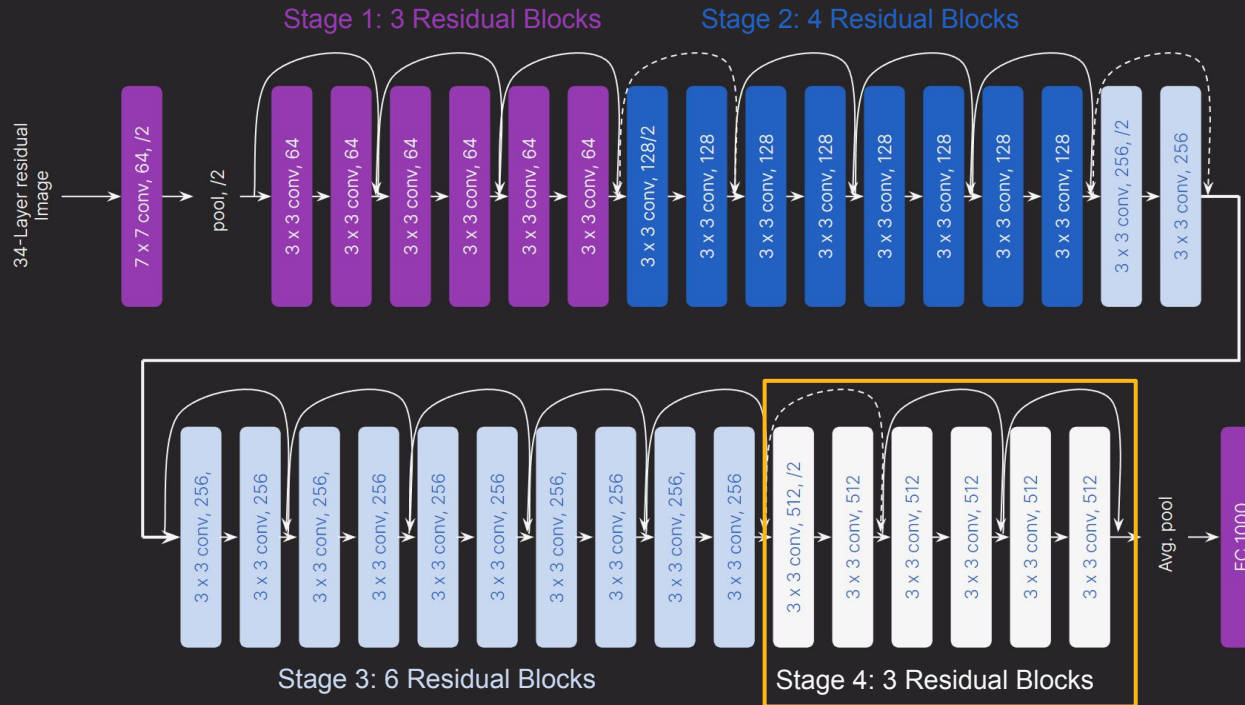
# ResNet 34

- Residual Blocks



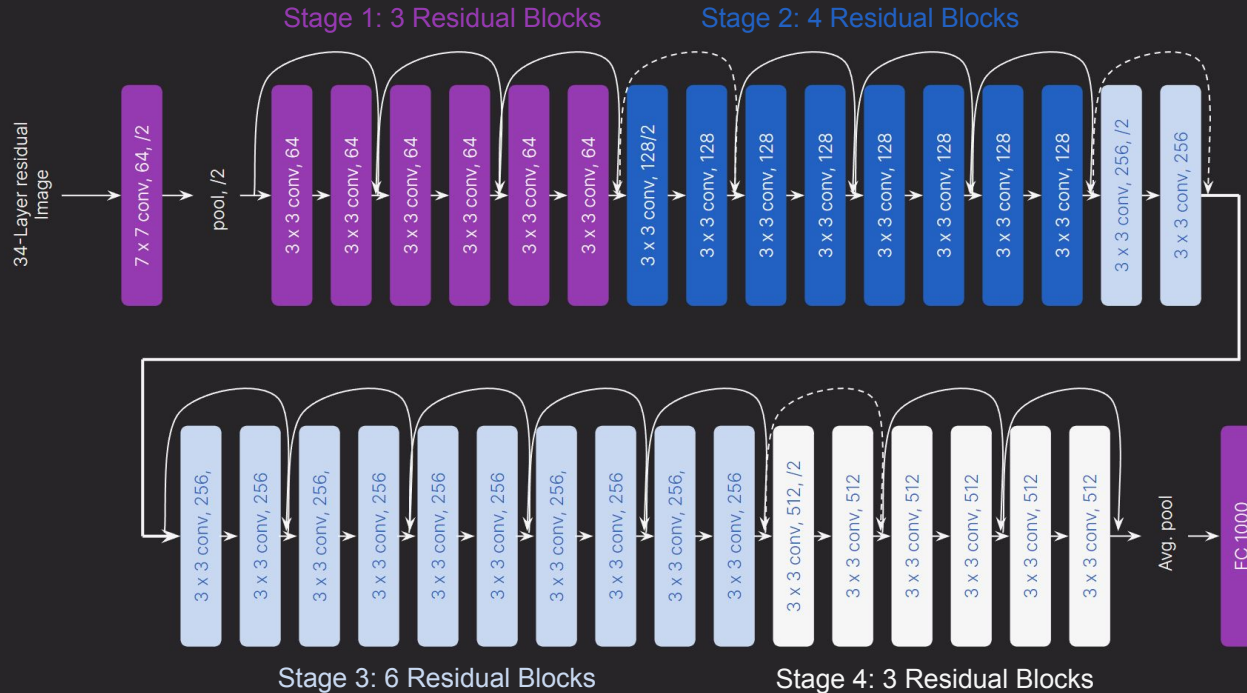
# ResNet 34

- Residual Blocks



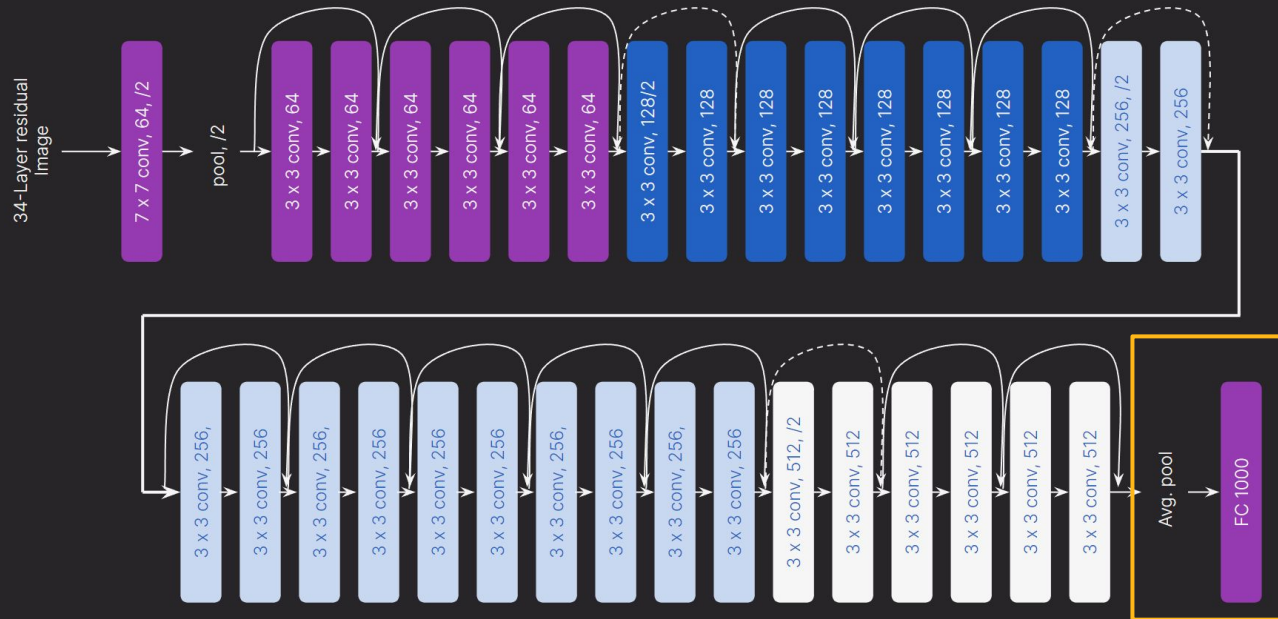
# ResNet 34

- Padding** ensures that channels being concatenated at skip connections and between different stages have the same dimensions.

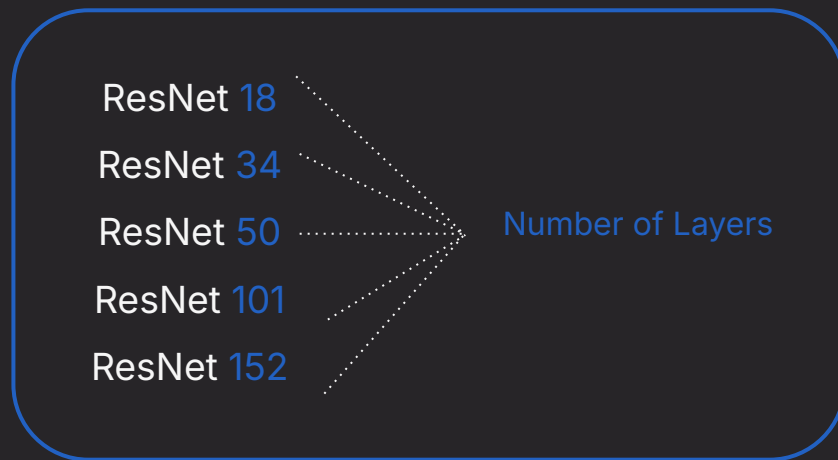


# ResNet 34

- **Global Average Pooling Layer:** Reduces each channel to a single value.
- **Fully Connected Layer:** translates 1×1 feature map into final classification layer.



# Common ResNet Configurations



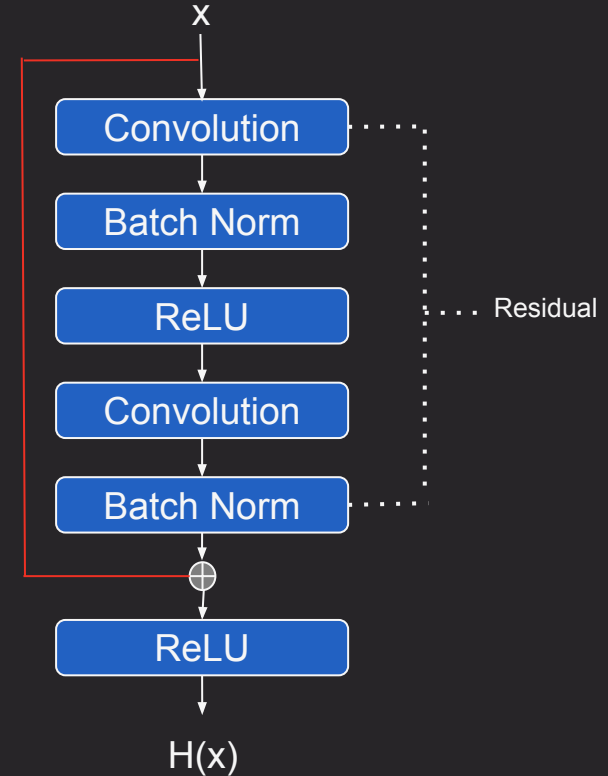
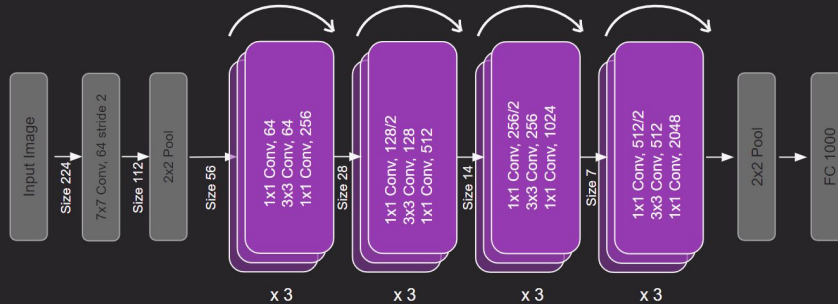
# UpNext: Hands-on

Layer Name	Output Size	Layer Details
Conv1	112x112	7x7, 64, stride 2
Max Pool	56x56	3x3, stride 2
Stage 1	56x56	3 x [3x3, 64]
Stage 2	28x28	4 x [3x3, 128], stride 2 for downsampling in the first block
Stage 3	14x14	6 x [3x3, 256], stride 2 for downsampling in the first block
Stage 4	7x7	3 x [3x3, 512], stride 2 for downsampling in the first block
Global Average Pooling	1x1	-
FC	1x1	Fully Connected Layer



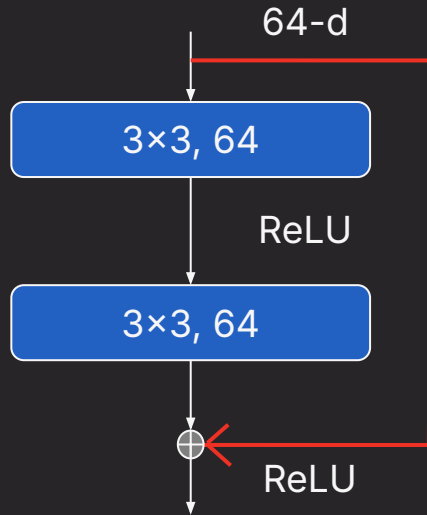
# ResNet Architecture

## Residual Block

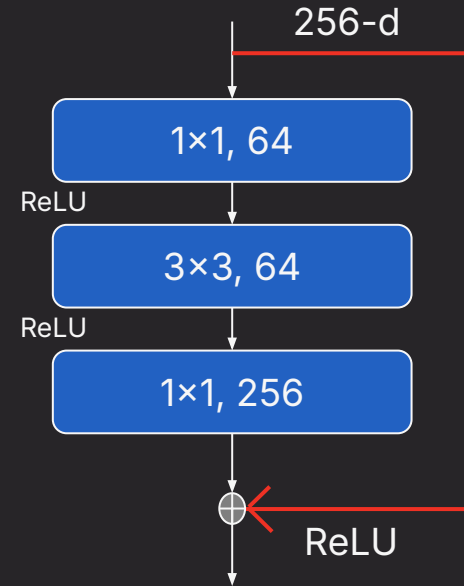


# ResNet Architecture

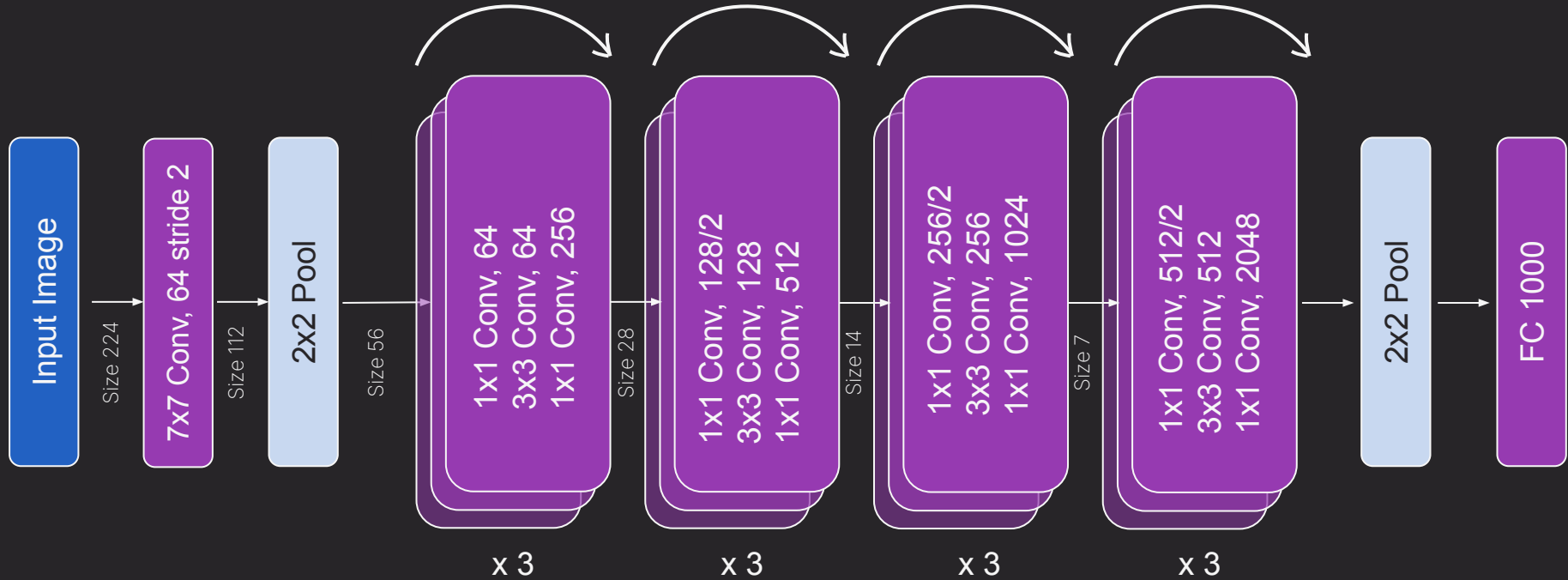
**Basic Blocks:** Simple with two convolutional layers.



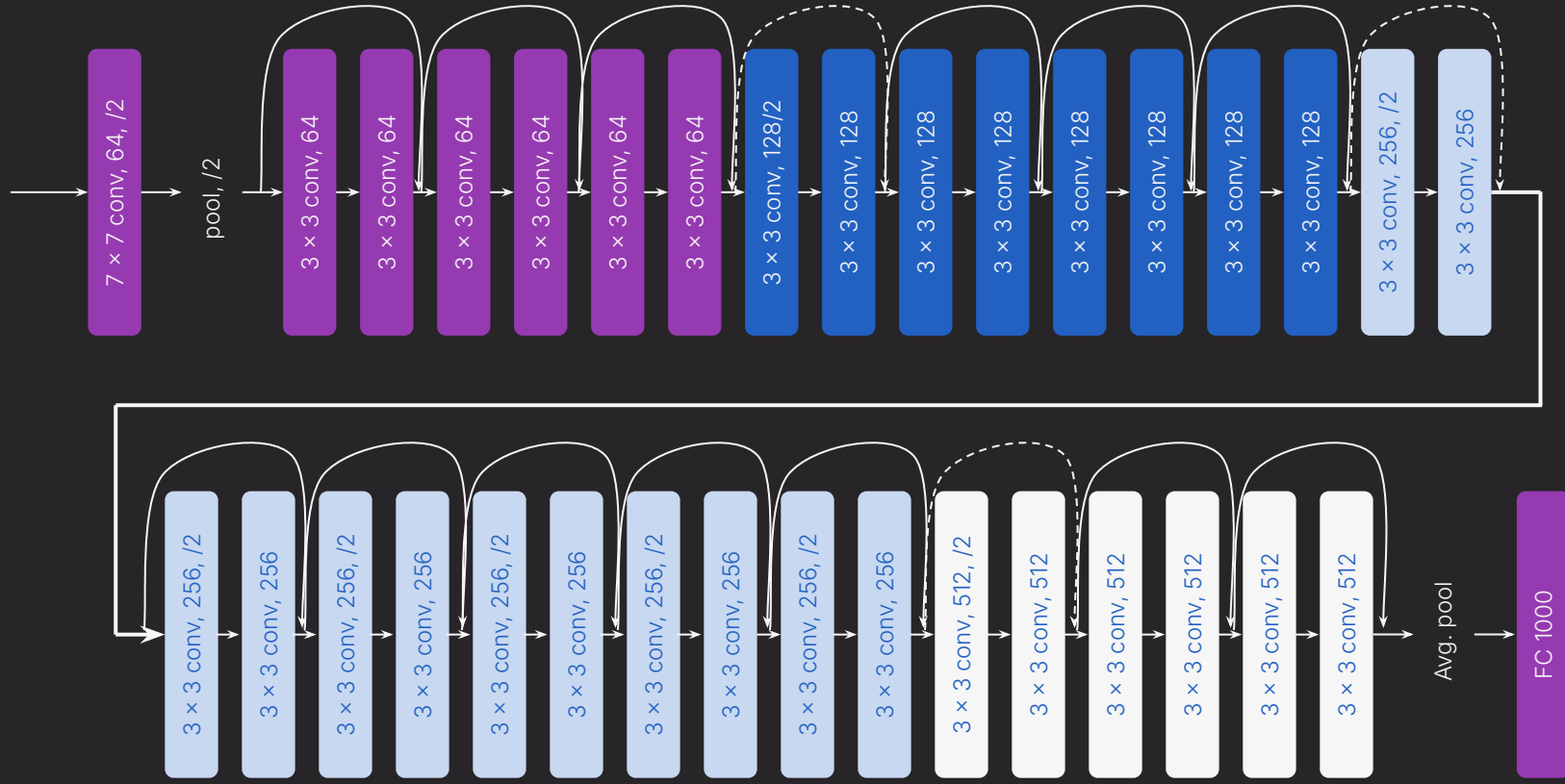
**Bottleneck Blocks:** Complex with three convolutional layers.



# In Air



34-Layer residual  
Image



34-Layer residual  
Image



34-Layer residual  
Image

