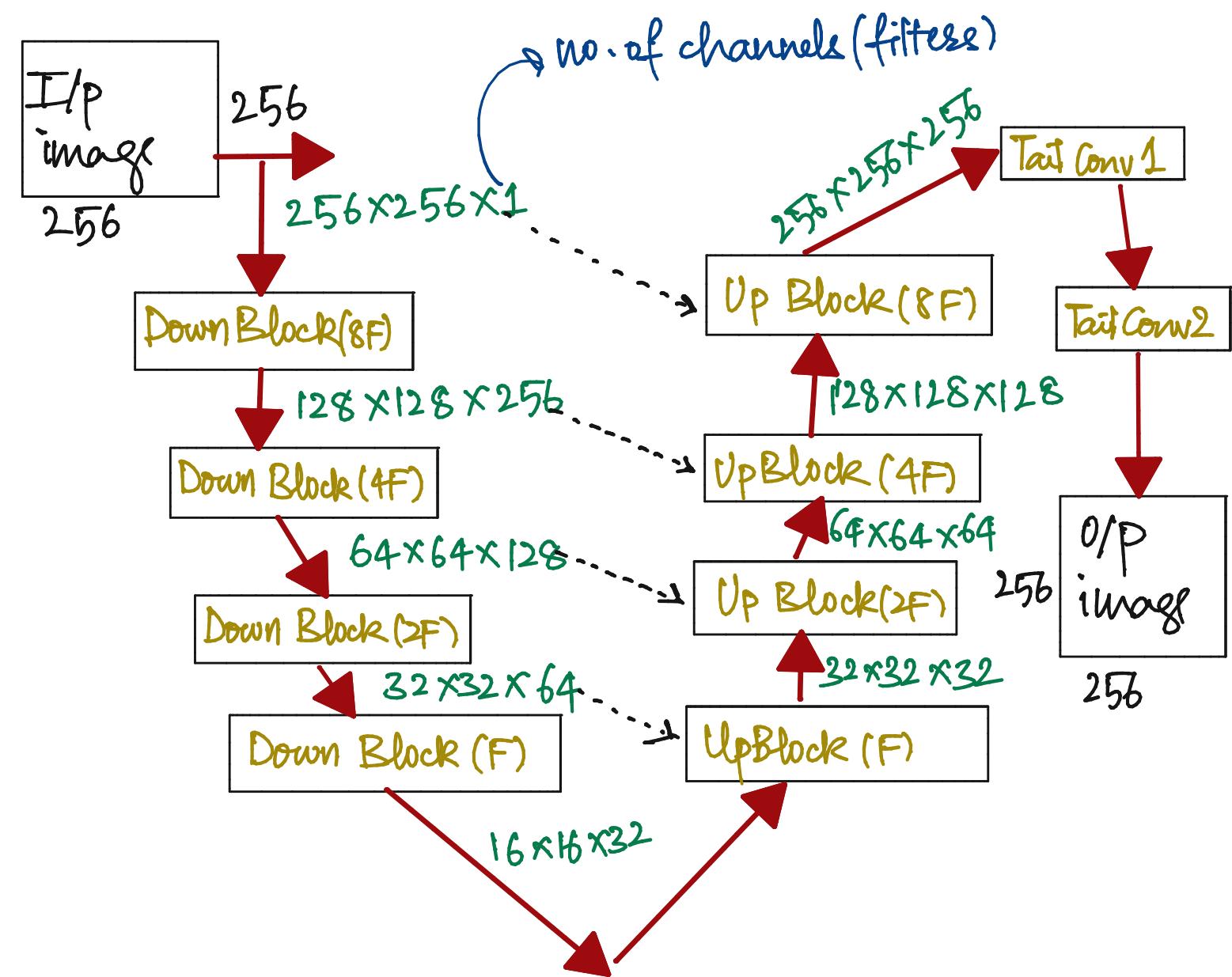


# V-NET Architecture →



- The V-net encoder is composed of sequence of  $K$  (here  $K=4$ ) encoding blocks, followed by the decoder, which consists of a sequence of  $K$  decoding blocks (up blocks) and a tail composed of last two convolutional layers.
- As opposed to the standard V-net, we reduce the no. of filters as the layers

are deeper on the encoder.

Tail conv1  $\rightarrow$  no. of filters = 2 (kernel size =  $1 \times 1$ )  
Tail conv2  $\rightarrow$  no. of filters = 1 (kernel size =  $1 \times 1$ )

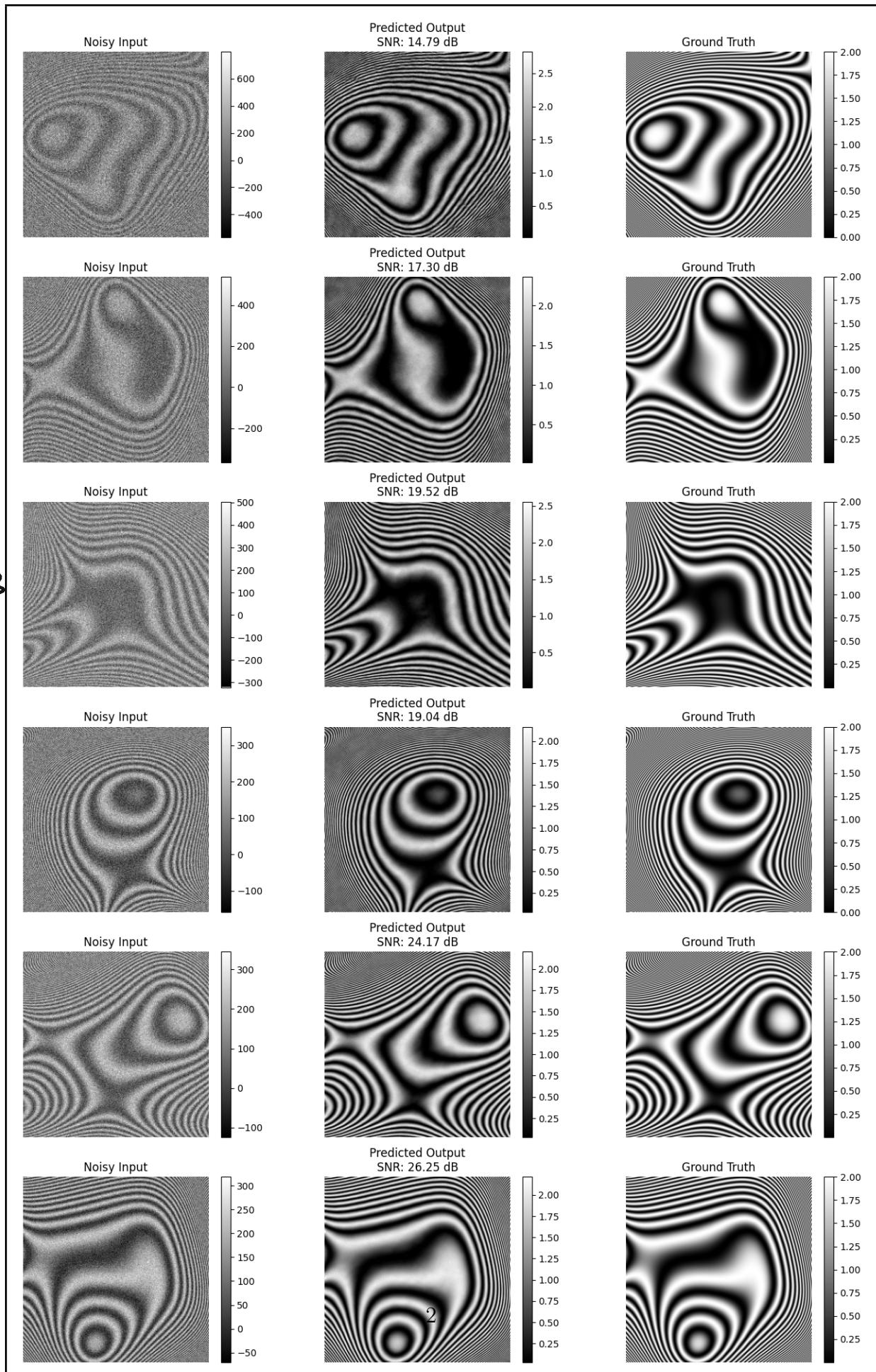


Figure 1: V-Net Results

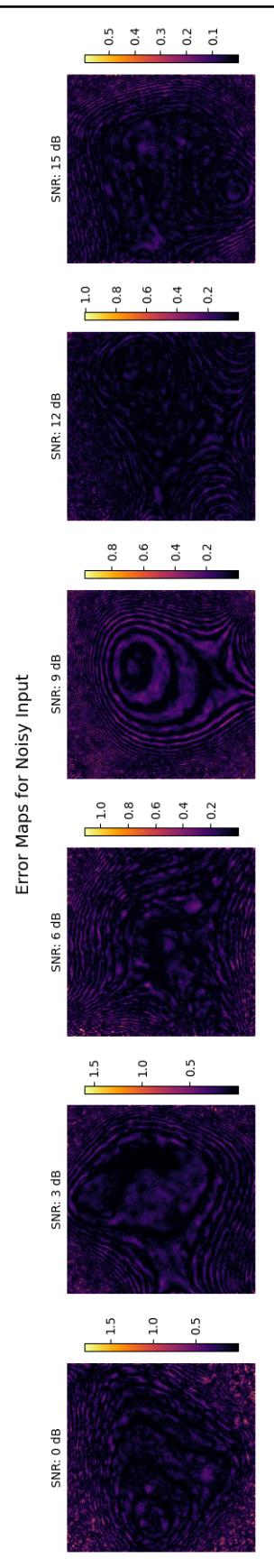
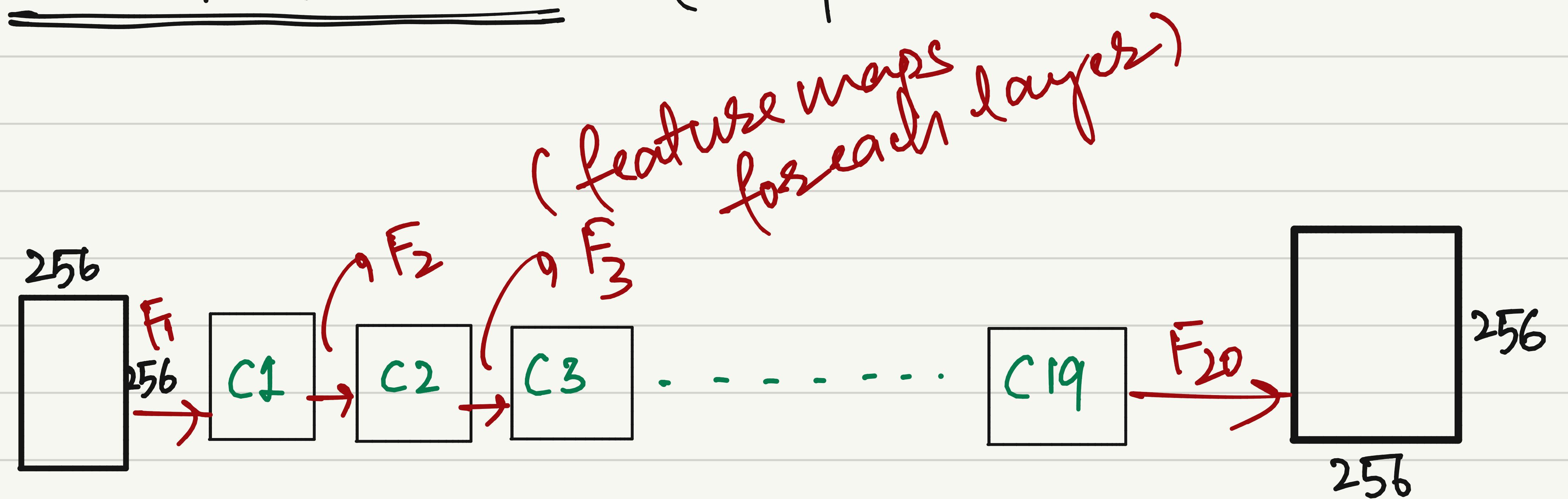


Figure 2: V-Net Error Maps

## CNN ARCHITECTURE: → (Deep CNN)



- 20 CNN layers (no fully connected or max pooling)

- Kernel size of  $F_1 \rightarrow F_{19} = 3 \times 3 \times 1$   
 $F_{20} = 1 \times 1 \times 1$

- No. of kernels  $F_1 \rightarrow F_5 = 8$   
 $F_6 \rightarrow F_8 = 32$   
 $F_9 \rightarrow F_{11} = 64$   
 $F_{12} \rightarrow F_{14} = 32$   
 $F_{15} \rightarrow F_{19} = 8$   
 $F_{20} = 1$ .

- Loss function in both models = mean absolute error

- Test dataset in both models =

$$\phi(x, y) = \sum_{n=1}^N a_n z_n(x_k, y_k)$$

- we randomly take aberration constant \$a\_n\$

- we take Zernike polynomials of degree (\$n=21\$)

$\text{RMSE} =$   
 $0.20728$

$\text{SNR} = 0 \text{ dB}$

$\text{RMSE} =$   
 $0.11922$   
 $\text{SNR} = 3 \text{ dB}$

$\text{SNR} = 6 \text{ dB}$   
 $\text{RMSE} =$   
 $0.09750$

$\text{SNR} = 9 \text{ dB}$   
 $\text{RMSE} =$   
 $0.08555$

$\text{SNR} = 12 \text{ dB}$   
 $\text{RMSE} =$   
 $0.07784$

$\text{SNR} = 15 \text{ dB}$   
 $\text{RMSE} =$   
 $0.06717$

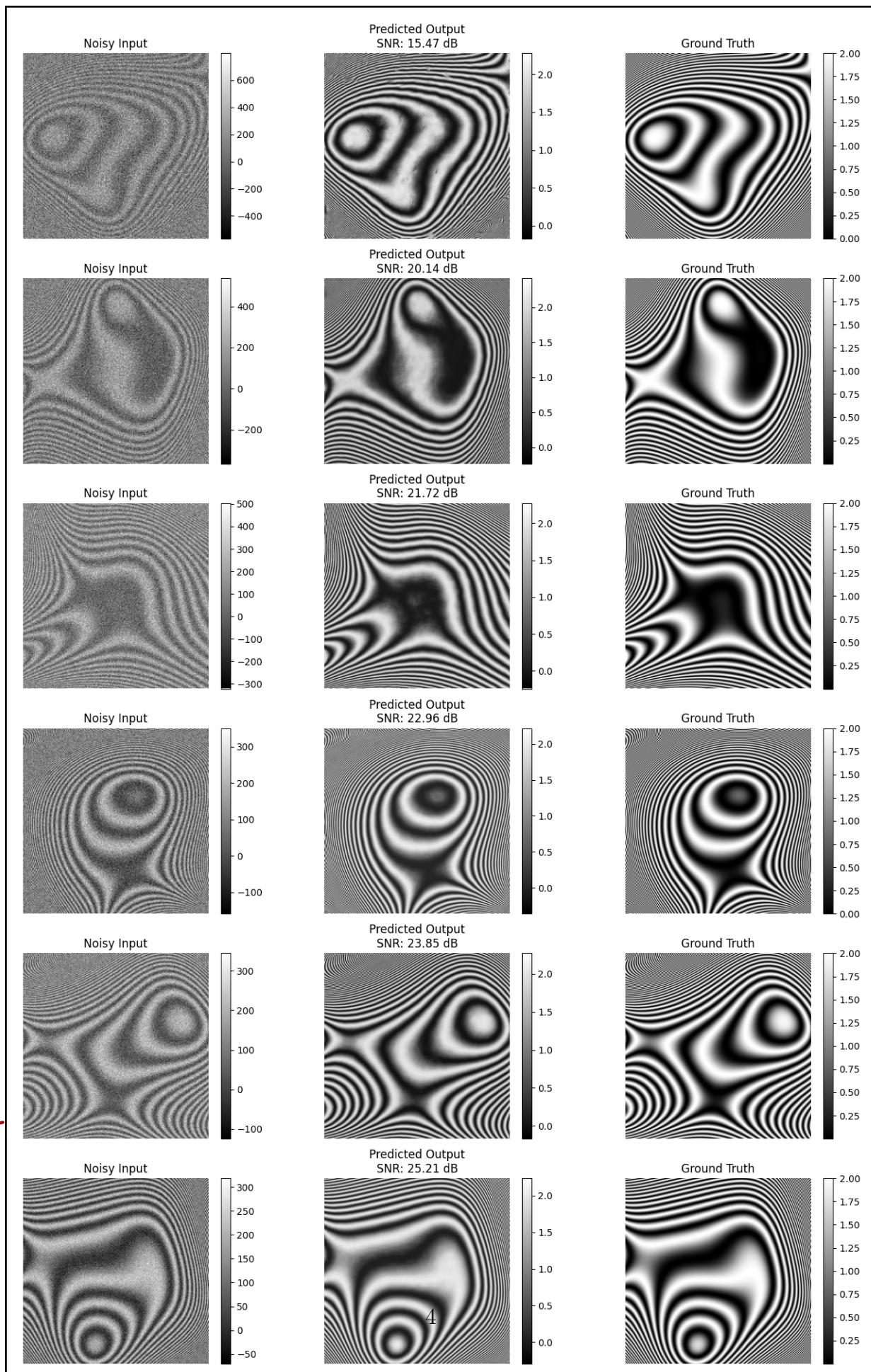


Figure 3: CNN Results

- SNR range in dataset = [0 - 16 dB]
- no. of images = 1600 ← equally distributed
- Fringe = random(90, 130) + random(90, 130)  
\*  $\cos(\phi)$
- Ground truth = 1 +  $\cos(\phi)$
- Epochs seen = 16 epochs for each model

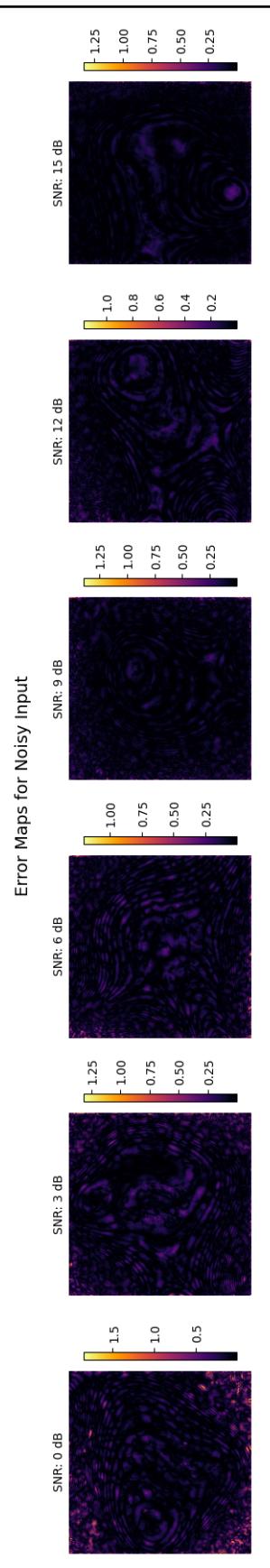


Figure 4: V-Net Error Maps

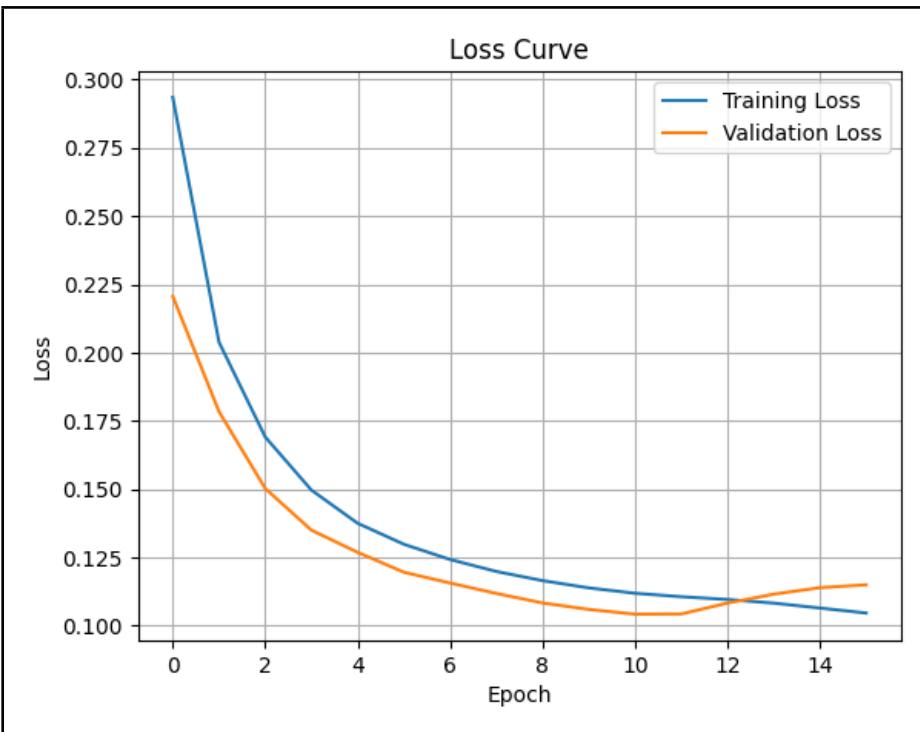


Figure 5: V-Net Loss Curve

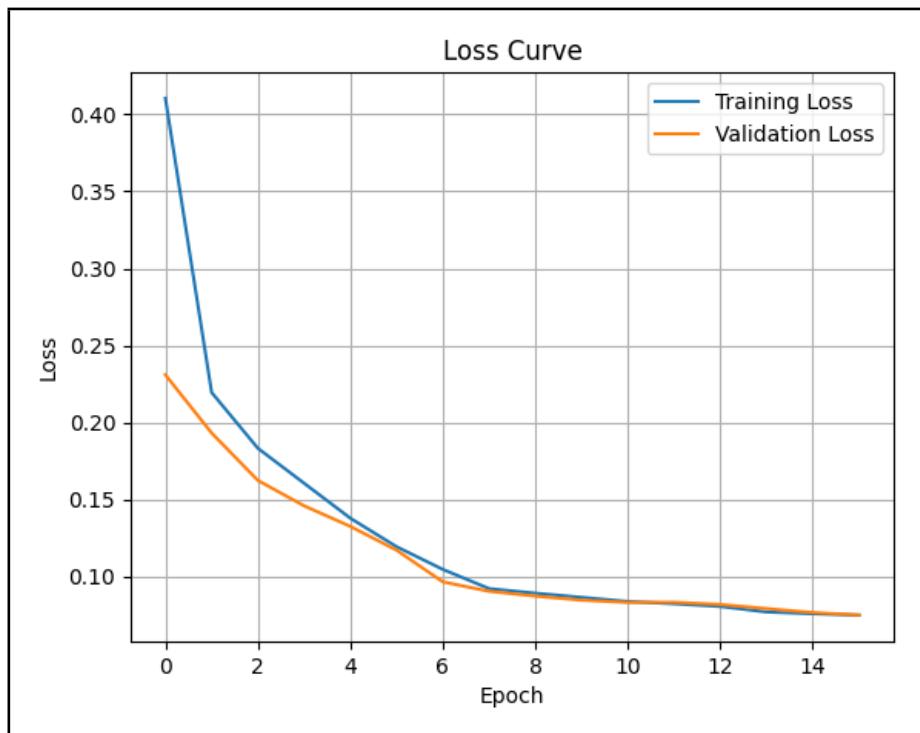


Figure 6: CNN Loss Curve

RMSE vs. SNR for V-Net and Deep CNN

