WHAT IS CLAIMED IS:

1. A method for video enhancement based on neural network based loop filtering using meta learning, the method being executed by at least one processor, the method comprising:

receiving reconstructed video data;

receiving one or more quality factors associated with the reconstructed video data;

determining a neural network based loop filter comprising neural network based loop filter parameters and a plurality of layers, wherein the neural network based loop filter parameters include shared parameters and adaptive parameters, wherein the shared parameters are based on an output from a layer of the neural network based loop filter and a first shared neural network loop filter, and wherein the adaptive parameters are based on the shared parameters and a first adaptive neural network loop filter; and

generating enhanced video data with artefact reduction, based on the one or more quality factors and the reconstructed video data, using the neural network based loop filter.

2. The method of claim 1, wherein the generating the enhanced video data using the neural network based loop filter comprises:

for each of the plurality of layers in the neural network based loop filter:

generating shared features based on an output from a previous layer, using the first shared neural network loop filter having first shared parameters;

computing estimated adaptive parameters, based on the output from the previous layer, the shared features, first adaptive parameters from the first adaptive neural network loop filter, and the one or more quality factors, using a prediction neural network; and

generating an output for a current layer, based on the shared features and the estimated adaptive parameters; and

generating the enhanced video data, based on an output of a last layer of the neural network based loop filter.

3. The method of claim 2, wherein training the prediction neural network comprises:

generating a first loss for training data corresponding to the one or more quality factors, and a second loss for validation data corresponding to the one or more quality factors, based on the one or more quality factors, the first shared parameters, the first adaptive parameters, and prediction parameters of the prediction neural network; and

updating the prediction parameters, based on gradients of the generated first loss and the generated second loss.

4. The method of claim 1, wherein the one or more quality factors associated with the reconstructed video data include at least one of a coding tree unit partition, a quantization parameter, a deblocking filter boundary strength, a coding unit motion vector, and a coding unit prediction mode.

5. The method of claim 2, wherein training the neural network based loop filter comprises:

generating an inner-loop loss for training data corresponding to the one or more quality factors, based on the one or more quality factors, the first shared parameters, and the first adaptive parameters;

first updating the first shared parameters and the first adaptive parameters, based on gradients of the generated inner-loop loss;

generating a meta loss for validation data corresponding to the one or more quality factors, based on the one or more quality factors, the first updated first shared parameters, and the first updated first adaptive parameters; and

second updating the first updated first shared parameters and the first updated first adaptive parameters, based on gradients of the generated meta loss.

6. The method of claim 1, wherein generating the received reconstructed video data comprises:

receiving a stream of video data including quantized video data and motion vector data;

dequantizing the stream of quantized data, using an inverse transformation, to obtain a recovered residual; and

generating the reconstructed video data based on the recovered residual and the motion vector data.

7. The method of claim 1, further including post-enhancement processing including applying at least one of a deblocking filter, an adaptive loop filter, a sample adaptive offset, and a cross-component adaptive loop filter to the enhanced video data.

8. The method of claim 1, wherein, prior to generating the enhanced video data, the method including pre-enhancement processing including applying at least one of a deblocking filter, an adaptive loop filter, a sample adaptive offset, and a cross-component adaptive loop filter to the enhanced video data.

9. The method of claim 1, wherein the reconstructed video data comprises a plurality of reconstructed input frames; and wherein the method of claim 1 is applied on a current frame of the plurality of reconstructed input frames.

10. The method of claim 1, wherein the generating the enhanced video data using the neural network based loop filter comprises:

for each of the plurality of layers in the neural network based loop filter:

generating a first shared output based on a previous combined output from a previous layer, using the first shared neural network loop filter having first shared parameters;

generating a first adaptive output based on the previous combined output from the previous layer, using the first adaptive neural network loop filter having first adaptive parameters; and

combining the first shared output and the first adaptive output to generate a first combined output; and

generating the enhanced video data, based on a combined output of a last layer of the neural network based loop filter.

11. The method of claim 4, wherein the combining comprises at least one of an addition, a concatenation, or a multiplication.

12. An apparatus comprising:

at least one memory configured to store program code; and

at least one processor configured to read the program code and operate as instructed by the program code, the program code comprising:

first receiving code configured to cause the at least one processor to receive reconstructed video data;

second receiving code configured to cause the at least one processor to receive one or more quality factors associated with the reconstructed video data;

first determining code configured to cause the at least one processor to determine a neural network based loop filter comprising neural network based loop filter parameters and a plurality of layers, wherein the neural network based loop filter parameters include shared parameters and adaptive parameters, wherein the shared parameters are based on an output from a layer of the neural network based loop filter and a first shared neural network loop filter, and wherein the adaptive parameters are based on the shared parameters and a first adaptive neural network loop filter; and

first generating code configured to cause the at least one processor to generate enhanced video data with artefact reduction, based on the one or more quality factors and the reconstructed video data, using the neural network based loop filter.

13. The apparatus of claim 12, wherein the first generating code comprises:

shared feature generating code configured to cause the at least one processor to generate, for a layer among the plurality of layers, shared features based on an output from a previous layer, using the first shared neural network loop filter having first shared parameters;

estimation code configured to cause the at least one processor to compute estimated adaptive parameters, for the layer among the plurality of layers, based on the output from the previous layer among the plurality of layers, the shared features, first adaptive parameters from the first adaptive neural network loop filter, and the one or more quality factors, using a prediction neural network; and

second generating code configured to cause the at least one processor to generate an output for the layer among the plurality of layers, based on the shared features and the estimated adaptive parameters; and

video enhancing code configured to cause the at least one processor to generate the enhanced video data, based on an output of a last layer among the plurality of layers of the neural network based loop filter.

14. The apparatus of claim 12, wherein the first receiving code comprises:

third receiving code configured to cause the at least one processor to receive a stream of video data including quantized video data and motion vector data;

dequantizing code configured to cause the at least one processor to dequantize the stream of quantized data, using an inverse transformation, to obtain a recovered residual; and

reconstruction code configured to cause the at least one processor to generate the reconstructed video data based on the recovered residual and the motion vector data.

15. The apparatus of claim 12, wherein the first generating code comprises:

first shared output generating code configured to cause the at least one processor to generate a first shared output, for a layer among the plurality of layers, based on a previous combined output from a previous layer among the plurality of layers, using the first shared neural network loop filter having first shared parameters;

first adaptive output generating code configured to cause the at least one processor to generate a first adaptive output for the layer among the plurality of layers, based on the previous combined output from the previous layer among the plurality of layers, using a first adaptive neural network loop filter having first adaptive parameters; and

combining code configured to cause the at least one processor to combine, for the layer among the plurality of layers, the first shared output and the first adaptive output to generate a first combined output; and

video enhancing code configured to cause the at least one processor to generate the enhanced video data, based on a combined output of a last layer among the plurality of layers of the neural network based loop filter.

16. A non-transitory computer-readable medium storing instructions that, when executed by at least one processor, causes the at least one processor to:

receive reconstructed video data;

receive one or more quality factors associated with the reconstructed video data;

determine a neural network based loop filter comprising neural network based loop filter parameters and a plurality of layers, wherein the neural network based loop filter parameters include shared parameters and adaptive parameters, wherein the shared parameters are based on

an output from a layer of the neural network based loop filter and a first shared neural network loop filter, and wherein the adaptive parameters are based on the shared parameters and a first adaptive neural network loop filter; and generate enhanced video data with artefact reduction, based on the one or more quality factors and the reconstructed video data, using the neural network based loop filter.

17. The non-transitory computer-readable medium of claim 16, wherein the generating the enhanced video data using the neural network based loop filter comprises instructions, when executed by the at least one processor, further cause the at least one processor to:

for each of the plurality of layers in the neural network based loop filter:

generate shared features based on an output from a previous layer, using the first shared neural network loop filter having first shared parameters;

compute estimated adaptive parameters, based on the output from the previous layer, the shared features, first adaptive parameters from the first adaptive neural network loop filter, and the one or more quality factors, using a prediction neural network; and

generate an output for a current layer, based on the shared features and the estimated adaptive parameters; and

generate the enhanced video data, based on an output of a last layer of the neural network based loop filter.

18. The non-transitory computer-readable medium of claim 16, wherein the generating the enhanced video data using the neural network based loop filter comprises instructions, when executed by the at least one processor, further cause the at least one processor to:

for each of the plurality of layers in the neural network based loop filter:

generate a first shared output based on a previous combined output from a previous layer, using the first shared neural network loop filter having first shared parameters;

generate a first adaptive output based on the previous combined output from the previous layer, using the first adaptive neural network loop filter having first adaptive parameters; and

combine the first shared output and the first adaptive output to generate a first combined output; and

generate the enhanced video data, based on a combined output of a last layer of the neural network based loop filter.

19. The non-transitory computer-readable medium of claim 17, wherein training the prediction neural network comprises instructions, when executed by the at least one processor, further cause the at least one processor to:

generate a first loss for training data corresponding to the one or more quality factors, and a second loss for validation data corresponding to the one or more quality factors, based on the one or more quality factors, the first shared parameters, the first adaptive parameters, and prediction parameters of the prediction neural network; and

update the prediction parameters, based on gradients of the generated first loss and the generated second loss.

20. The non-transitory computer-readable medium of claim 16, wherein generating the received reconstructed video data comprises:

receive a stream of video data including quantized video data and motion vector data;

dequantize the stream of quantized data, using an inverse transformation, to obtain a recovered residual; and

generate the reconstructed video data based on the recovered residual and the motion vector data.