

WHAT IS CLAIMED IS:

1. A method of adaptive neural image compression by meta-learning, the method being performed by at least one processor, and the method comprising:

generating a substitute input image and a substitute target quality control parameter via a plurality of iterations using an original input image and an original target quality control parameter, wherein the substitute input image is a modified version of the original input image and the substitute target quality control parameter is a modified version of the original target quality control parameter; and

encoding the substitute input image, based on the substitute input image and the substitute target quality control parameter, using an encoding neural network, to generate a compressed representation of the substitute input image.

2. The method of claim 1, wherein the generating the substitute input image comprises, for each of a plurality of iterations:

computing an overall rate-distortion loss using the original target quality control parameter;

computing a gradient of the overall rate-distortion loss using backpropagation; and

updating the substitute input image and the substitute target quality control parameter based on the gradient of the overall rate-distortion loss.

3. The method of claim 2, wherein a number of the plurality of iterations is based on updates to the substitute input image being less than a first preset threshold.

4. The method of claim 2, wherein a number of the plurality of iterations is based on updates to the substitute target quality control parameter being less than a second threshold.
5. The method of claim 2, wherein performing a first iteration from the plurality of iterations comprises initializing the substitute input image as the original input image and the substitute target quality control parameter as the original target quality control parameter.
6. The method of claim 1, further comprising generating a compressed bitstream based on the compressed representation of the substitute input image using quantization and entropy encoding.
7. The method of claim 1, further comprising:
 - receiving a recovered compressed bitstream and the substitute target quality control parameter;
 - generating a recovered compressed representation, based on the recovered compressed bitstream and the received substitute target quality control parameter using dequantization and entropy decoding; and
 - decoding the generated recovered compressed representation based on the received substitute target quality control parameter using a decoding neural network to reconstruct an output image.
8. The method of claim 1, wherein the encoding comprises:

generating a first combined output based on a first combination of a first shared encoding performed on the substitute input image using first shared encoding parameters and a first adaptive encoding performed on the substitute input image using first adaptive encoding parameters; and

generating a second combined output based on a second combination of a second shared encoding performed on the first combined output using second shared encoding parameters and a second adaptive encoding performed on the first combined output using second adaptive encoding parameters.

9. The method of claim 8, wherein generating the first combined output comprises:

generating shared features based on the substitute input image and the first shared encoding parameters;

generating estimated first adaptive encoding parameters based on the substitute input image, the substitute target quality control parameter, the first adaptive encoding parameters, and the generated shared features, using a prediction neural network; and

generating the first combined output based on the generated shared features and the generated estimated first adaptive encoding parameters.

10. An apparatus for adaptive neural image compression by meta-learning, the apparatus comprising:

at least one memory configured to store computer program code; and

at least one processor configured to access the computer program code and operate as instructed by the computer program code, the computer program code including:

first generating code configured to cause the at least one processor to generate a substitute input image and a substitute target quality control parameter using an original input image and an original target quality control parameter, wherein the substitute input image is a modified version of the original input image and the substitute target quality control parameter is a modified version of the original target quality control parameter; and

encoding code configured to cause the at least one processor to encode the substitute input image, based on the substitute input image and the substitute target quality control parameter, using an encoding neural network, to generate a compressed representation of the substitute input image.

11. The apparatus of claim 10, wherein the first generating code further comprises:

for each of a plurality of iterations:

first computing code configured to cause the at least one processor to compute an overall rate-distortion loss using the original target quality control parameter;

second computing code configured to cause the at least one processor to compute a gradient of the overall rate-distortion loss using backpropagation; and

first updating code configured to cause the at least one processor to update the substitute input image and the substitute target quality control parameter based on the gradient of the overall rate-distortion loss.

12. The apparatus of claim 11, wherein for a first iteration, the first generating code comprises second generating code configured to cause the at least one processor to generate a

compressed bitstream based on the compressed representation of the substitute input image using quantization and entropy encoding.

13. The apparatus of claim 10, wherein the program code further includes:

receiving code configured to cause the at least one processor to receive a recovered compressed bitstream and the substitute target quality control parameter;

third generating code configured to cause the at least one processor to generate a recovered compressed representation, based on the recovered compressed bitstream and the received substitute target quality control parameter using dequantization and entropy decoding; and

decoding code configured to cause the at least one processor to decode the generated recovered compressed representation based on the received substitute target quality control parameter using a decoding neural network to reconstruct an output image.

14. The apparatus of claim 10, wherein the encoding code comprises:

fourth generating code configured to cause the at least one processor to generate a first combined output based on a first combination of a first shared encoding performed on the substitute input image using first shared encoding parameters and a first adaptive encoding performed on the substitute input image using first adaptive encoding parameters; and

fifth generating code configured to cause the at least one processor to generate a second combined output based on a second combination of a second shared encoding performed on the first combined output using second shared encoding parameters and a second adaptive encoding performed on the first combined output using second adaptive encoding parameters.

15. The apparatus of claim 14, wherein the fourth generating code comprises:
- sixth generating code configured to cause the at least one processor to generate shared features based on the substitute input image and the first shared encoding parameters;
 - seventh generating code configured to cause the at least one processor to generate estimated first adaptive encoding parameters based on the substitute input image, the substitute target quality control parameter, the first adaptive encoding parameters, and the generated shared features, using a prediction neural network; and
 - eighth generating code configured to cause the at least one processor to generate the first combined output based on the generated shared features and the generated estimated first adaptive encoding parameters.
16. A non-transitory computer readable medium storing a storing instructions, the instructions comprising: one or more instructions that, when executed by one or more processors of a device for adaptive neural image compression by meta-learning, cause the one or more processors to:
- generate a substitute input image and a substitute target quality control parameter using an original input image and an original target quality control parameter, wherein the substitute input image is a modified version of the original input image and the substitute target quality control parameter is a modified version of the original target quality control parameter; and
 - encode the substitute input image, based on the substitute input image and the substitute target quality control parameter, using an encoding neural network, to generate a compressed representation of the substitute input image.

17. The non-transitory computer readable medium of claim 16, wherein the generating the substitute input image comprises, for each of a plurality of iterations:

computing an overall rate-distortion loss using the original target quality control parameter;

computing a gradient of the overall rate-distortion loss using backpropagation; and

updating the substitute input image and the substitute target quality control parameter based on the gradient of the overall rate-distortion loss.

18. The non-transitory computer readable medium of claim 16, wherein the one or more instructions further cause the one or more processors to generate a compressed bitstream based on the compressed representation of the substitute input image using quantization and entropy encoding.

19. The non-transitory computer readable medium of claim 16, wherein the one or more instructions further cause the one or more processors to:

receive a recovered compressed bitstream and the substitute target quality control parameter;

generate a recovered compressed representation, based on the recovered compressed bitstream and the received substitute target quality control parameter using dequantization and entropy decoding; and

decode the generated recovered compressed representation based on the received substitute target quality control parameter using a decoding neural network to reconstruct an output image.

20. The non-transitory computer readable medium of claim 16, wherein encoding comprises:

generating a first combined output based on a first combination of a first shared encoding performed on the substitute input image using first shared encoding parameters and a first adaptive encoding performed on the substitute input image using first adaptive encoding parameters; and

generating a second combined output based on a second combination of a second shared encoding performed on the first combined output using second shared encoding parameters and a second adaptive encoding performed on the first combined output using second adaptive encoding parameters.