CLAIMS

1. A method of decoding video data, the method comprising:

determining, based on syntax elements in a bitstream that comprises an encoded representation of the video data, residual quantized samples of a block of the video data;

determining quantized residual values based on the residual quantized samples, wherein determining the quantized residual values comprises one of:

based on the intra prediction being vertical prediction, determining the quantized residual values as:

$$Q(r_{i,j}) = \sum_{k=0}^{i} \tilde{r}_{k,j}, \quad 0 \le i \le (M-1), \quad 0 \le j \le (N-1)$$

where $Q(r_{i,j})$ is a quantized residual value at position i, j, $\tilde{r}_{k,j}$ is one of the residual quantized samples, M is a number of rows of the block, and N is a number of columns of the block, or

based on the intra prediction being horizontal prediction, determining the quantized residual values as:

$$Q(r_{i,j}) = \sum_{k=0}^{j} \tilde{r}_{i,k}, \quad 0 \le i \le (M-1), \quad 0 \le j \le (N-1)$$

where $\tilde{r}_{i,k}$ is one of the residual quantized samples,;

after determining the quantized residual values, inverse quantizing the quantized residual values;

generating predicted values by performing intra prediction for the block using unfiltered samples from above or left block boundary samples; and

reconstructing original sample values of the block based on the inverse-quantized quantized residual values and the prediction values.

2. A method of encoding video data, the method comprising:

generating a block of predicted values by performing intra prediction for a block of the video data using unfiltered samples from above or left block boundary samples;

generating residual values based on original sample values of the block and the predicted values;

quantizing the residual values;

after quantizing the residual values, determining residual quantized samples based on the quantized residual values, wherein determining the residual quantized samples comprises:

based on the intra prediction being vertical prediction, determining the residual quantized samples as:

$$\tilde{r}_{i,j} = \begin{cases} Q(r_{i,j}), & i = 0, \quad 0 \le j \le (N-1) \\ Q(r_{i,j}) - Q(r_{(i-1),j}), & 1 \le i \le (M-1), \quad 0 \le j \le (N-1) \end{cases}$$

where $\tilde{r}_{i,j}$ is a residual quantized sample at position i, j, $Q(r_{i,j})$ and $Q(r_{(i-1),j})$ are quantized residual values, M is a number of rows of the block, and N is a number of columns of the block, or

based on the intra prediction being horizontal prediction, determining the residual quantized samples as:

$$\tilde{r}_{i,j} = \begin{cases} Q(r_{i,j}), & 0 \le i \le (M-1), j = 0 \\ Q(r_{i,j}) - Q(r_{i,(j-1)}), & 0 \le i \le (M-1), \quad 1 \le j \le (N-1) \end{cases}$$

$Q(r_{i,(j-1)})$ is one of the quantized residual values; and

signaling the residual quantized samples.

3. A device for decoding video data, the device comprising:

a memory configured to store the video data; and

one or more processors implemented in circuitry, the one or more processors configured to:

determine, based on syntax elements in a bitstream that comprises an encoded representation of the video data, residual quantized samples of a block of the video data;

determine quantized residual values based on the residual quantized samples, wherein the one or more processors, are configured such that, as part of determining the quantized residual values, the one or more processors:

based on the intra prediction being vertical prediction, determine the quantized residual values as:

$$Q(r_{i,j}) = \sum_{k=0}^{i} \tilde{r}_{k,j}, \quad 0 \le i \le (M-1), \quad 0 \le j \le (N-1)$$

where $Q(r_{i,j})$ is a quantized residual value at position i, j, $\tilde{r}_{k,j}$ is one of the residual quantized samples, M is a number of rows of the block, and N is a number of columns of the block, or

based on the intra prediction being horizontal prediction, determine the quantized residual values as:

$$Q(r_{i,j}) = \sum_{k=0}^{j} \tilde{r}_{i,k}, \quad 0 \leq i \leq (M-1), \quad 0 \leq j \leq (N-1)$$

$\tilde{r}_{i,k}$ is one of the residual quantized samples;

after determining the quantized residual values, inverse quantize the quantized residual values;

generate predicted values by performing intra prediction for the block using unfiltered samples from above or left block boundary samples; and

reconstruct original sample values of the block based on the inverse-quantized quantized residual values and the prediction values.

4. The device of claim 3, further comprising a display configured to display decoded video data.

5. The device of claim 3, wherein the device comprises one or more of a camera, a computer, a mobile device, a broadcast receiver device, or a set-top box.

6. A device for encoding video data, the device comprising:

a memory configured to store the video data; and

one or more processors implemented in circuitry, the one or more processors configured to:

generate a block of predicted values by performing intra prediction for a block of the video data using unfiltered samples from above or left block boundary samples;

generate residual values based on original sample values of the block and the predicted values;

quantize the residual values;

after quantizing the residual values, determine residual quantized samples based

on the quantized residual values, the one or more processors are configured such that, as part of determining the residual quantized samples, the one or more processors:

based on the intra prediction being vertical prediction, determine the residual quantized samples as:

$$\tilde{r}_{i,j} = \begin{cases} Q(r_{i,j}), & i = 0, \quad 0 \le j \le (N-1) \\ Q(r_{i,j}) - Q(r_{(i-1),j}), & 1 \le i \le (M-1), \quad 0 \le j \le (N-1) \end{cases}$$

where $\tilde{r}_{i,j}$ is a residual quantized sample at position i, j, $Q(r_{i,j})$ and $Q(r_{(i-1),j})$ are quantized residual values, M is a number of rows of the block, and N is a number of columns of the block, or

based on the intra prediction being horizontal prediction, determine the residual quantized samples as:

$$\tilde{r}_{i,j} = \begin{cases} Q(r_{i,j}), & 0 \le i \le (M-1), j = 0 \\ Q(r_{i,j}) - Q(r_{i,(j-1)}), & 0 \le i \le (M-1), \quad 1 \le j \le (N-1) \end{cases}$$

where $Q(r_{i,(j-1)})$ is one of the quantized residual values; and

signal the residual quantized samples.

7. The device of claim 6, wherein the device comprises one or more of a camera, a computer, a mobile device, a broadcast receiver device, or a set-top box.

8. A device for decoding video data, the device comprising:

means for determining, based on syntax elements in a bitstream that comprises an encoded representation of the video data, residual quantized samples of a block of the video data;
means for determining quantized residual values based on the residual quantized samples, wherein the means for determining the quantized residual values comprises at least one of:

means for determining, based on the intra prediction being vertical prediction, the quantized residual values as:

$$Q(r_{i,j}) = \sum_{k=0}^{i} \tilde{r}_{k,j}, \quad 0 \le i \le (M-1), \quad 0 \le j \le (N-1)$$

where $Q(r_{i,j})$ is a quantized residual value at position i, j, $\tilde{r}_{k,j}$ is one of the residual quantized samples, M is a number of rows of the block, and N is a number of columns of

the block, or

means for determining, based on the intra prediction being horizontal prediction, the quantized residual values as:

$$Q(r_{i,j}) = \sum_{k=0}^{j} \tilde{r}_{i,k}, \quad 0 \le i \le (M-1), \quad 0 \le j \le (N-1)$$

$\tilde{r}_{i,k}$ is one of the residual quantized samples;

means for inverse quantizing, after determining the quantized residual values, the quantized residual values;

means for generating predicted values by performing intra prediction for the block using unfiltered samples from above or left block boundary samples; and

means for reconstructing original sample values of the block based on the inverse-quantized quantized residual values and the prediction values.

9. A device for encoding video data, the device comprising:

means for generating a block of predicted values by performing intra prediction for a block of the video data using unfiltered samples from above or left block boundary samples;

means for generating residual values based on original sample values of the block and the predicted values;

means for quantizing the residual values;

means for determining, after quantizing the residual values, residual quantized samples based on the quantized residual values, wherein the means for determining the residual quantized samples comprises at least one of:

means for determining, based on the intra prediction being vertical prediction, the residual quantized samples as:

$$\tilde{r}_{i,j} = \begin{cases} Q(r_{i,j}), & i = 0, \quad 0 \le j \le (N-1) \\ Q(r_{i,j}) - Q(r_{(i-1),j}), & 1 \le i \le (M-1), \quad 0 \le j \le (N-1) \end{cases}$$

where $\tilde{r}_{i,j}$ is a residual quantized sample at position i, j, $Q(r_{i,j})$ and $Q(r_{(i-1),j})$ are quantized residual values, M is a number of rows of the block, and N is a number of columns of the block, or

means for determining, based on the intra prediction being horizontal prediction, the residual quantized samples as:

$$\tilde{r}_{i,j} = \begin{cases} Q(r_{i,j}), & 0 \le i \le (M-1), j = 0 \\ Q(r_{i,j}) - Q(r_{i,(j-1)}), & 0 \le i \le (M-1), \quad 1 \le j \le (N-1) \end{cases}$$

where $Q(r_{i,(j-1)})$ is one of the quantized residual values; and

means for signaling the residual quantized samples.

10. A computer-readable storage medium having stored thereon instructions that, when executed, cause one or more processors to:

determine, based on syntax elements in a bitstream that comprises an encoded representation of the video data, residual quantized samples of a block of the video data;

determine quantized residual values based on the residual quantized samples, wherein the instructions that cause the one or more processors to determine the quantized residual values include instructions that, when executed, cause the one or more processors to:

based on the intra prediction being vertical prediction, determine the quantized residual values as:

$$Q(r_{i,j}) = \sum_{k=0}^{i} \tilde{r}_{k,j}, \quad 0 \le i \le (M-1), \quad 0 \le j \le (N-1)$$

where $Q(r_{i,j})$ is a quantized residual value at position i, j, $\tilde{r}_{k,j}$ is one of the residual quantized samples, M is a number of rows of the block, and N is a number of columns of the block, or

based on the intra prediction being horizontal prediction, determine the quantized residual values as:

$$Q(r_{i,j}) = \sum_{k=0}^{j} \tilde{r}_{i,k}, \quad 0 \le i \le (M-1), \quad 0 \le j \le (N-1)$$

where $\tilde{r}_{i,k}$ is one of the residual quantized samples;

after determining the quantized residual values, inverse quantize the quantized residual values;

generate predicted values by performing intra prediction for the block using unfiltered samples from above or left block boundary samples; and

reconstruct original sample values of the block based on the inverse-quantized quantized residual values and the prediction values.

11. A computer-readable storage medium having stored thereon instructions that, when executed, cause one or more processors to:

generate a block of predicted values by performing intra prediction for a block of the video data using unfiltered samples from above or left block boundary samples;

generate residual values based on original sample values of the block and the predicted values;

quantize the residual values;

after quantizing the residual values, determine residual quantized samples based on the quantized residual values, wherein the instructions that cause the one or more processors to determine the residual quantized samples comprise instructions that, when executed, cause the one or more processors to:

based on the intra prediction being vertical prediction, determine the residual quantized samples as:

$$\tilde{r}_{i,j} = \begin{cases} Q(r_{i,j}), & i = 0, \quad 0 \le j \le (N-1) \\ Q(r_{i,j}) - Q(r_{(i-1),j}), & 1 \le i \le (M-1), \quad 0 \le j \le (N-1) \end{cases}$$

where $\tilde{r}_{i,j}$ is a residual quantized sample at position i, j, $Q(r_{i,j})$ and $Q(r_{(i-1),j})$ are quantized residual values, M is a number of rows of the block, and N is a number of columns of the block, or

based on the intra prediction being horizontal prediction, determine the residual quantized samples as:

$$\tilde{r}_{i,j} = \begin{cases} Q(r_{i,j}), & 0 \le i \le (M-1), j = 0 \\ Q(r_{i,j}) - Q(r_{i,(j-1)}), & 0 \le i \le (M-1), \quad 1 \le j \le (N-1) \end{cases}$$

where $Q(r_{i,(j-1)})$ is one of the quantized residual values; and

signal the residual quantized samples.