CLAIMS

1. A character image processing method, comprising:

obtaining at least one image block containing a character in a character image to be processed;

obtaining, on the basis of a neural network, image block form transformation information of each of the at least one image block, the image block form transformation information being used for changing a character orientation in an image block to a predetermined orientation, wherein the neural network comprises: a shared neural network configured to extract an image feature, a first branch configured to output perspective transformation information of the image block, and a second branch configured to output image block rotation information indicating an integer multiple of 90 degrees, wherein an output end of the shared neural network is respectively connected to input ends of the first branch and the second branch;

performing, according to the image block form transformation information, form transformation processing on the character image; and

performing character recognition on the character image to be processed which is subjected to the form transformation.

2. The method according to claim 1, wherein the obtaining at least one image block containing a character in a character image to be processed comprises:

performing cutting processing on the character image to be processed to obtain the at least one image block containing the character in the character image to be processed; or

performing filling processing on the character image to be processed to obtain the at least one image block containing the entire character image to be processed.

3. The method according to claim 2, wherein the performing cutting processing on the character image to be processed to obtain the at least one image block containing the character in the character image to be processed comprises:

cutting, by taking the central position of the character image to be processed as the center, and the short side of the character image to be processed as the side length, one image block from the character image to be processed.

4. The method according to any one of claims 1 to 3, wherein the image block form transformation information comprises at least one of:

perspective transformation information of the image block; or

image block rotation information indicating an integer multiple of 90 degrees.

5. The method according to claim 4, wherein the performing, according to the image block form transformation information, form transformation processing on the character image to be processed comprises:

performing, according to the image block rotation information, rotation processing by an integer multiple of 90 degrees on the character image to be processed;

determining, according to the perspective transformation information, a perspective transformation matrix; and

performing perspective transformation on a rotated character image by using the perspective transformation matrix.

6. The method according to claim 5, wherein in a case where the at least one image block is a plurality of image blocks, the performing, according to the image block rotation information, rotation processing by the integer multiple of 90 degrees on the character image comprises:

obtaining a probability value of the image block rotation information of each image block in the plurality of image blocks;

selecting, from a plurality pieces of the image block rotation information of the plurality of image blocks, a piece of image block rotation information with a highest probability value; and

performing, according to the selected image block rotation information, rotation processing by an integer multiple of 90 degrees on the plurality of image blocks.

7. The method according to claim 5 or 6, wherein in a case where the at least one image block is a plurality of image blocks, the determining, according to the perspective transformation information, a perspective transformation matrix and performing perspective transformation on a rotated character image to be processed by using the perspective transformation matrix comprises:

determining, according to the perspective transformation information of each image block in the plurality of image blocks, a perspective transformation matrix of the each image block ;

determining, according to the perspective transformation matrix of the each image block, a perspective transformation average matrix ; and

performing, by using the perspective transformation average matrix, the perspective transformation on the plurality of rotated image blocks.

8. The method according to any one of claims 1 to 7, wherein the method further comprises: obtaining indication information indicating whether an area occupied by the character in the image block satisfies a predetermined requirement; and

the performing, according to the image block form transformation information, form transformation processing on the character image comprises:

in a case where the indication information indicates that the area occupied by the character in the image block satisfies the predetermined requirement, performing, according to the image block form transformation information, form transformation processing on the character image to be processed.

9. The method according to claim 8, wherein

in a case where the indication information indicates that the area occupied by the character in the image block does not satisfy the predetermined requirement, the operation of performing, according to the image block form transformation information, form transformation processing on the character image to be processed is not executed.

10. The method according to claim 8, wherein the obtaining indication information indicating whether an area occupied by the character in the image block satisfies a predetermined requirement comprises:

obtaining, on the basis of the neural network, the indication information indicating whether the area occupied by the character in the image block satisfies the predetermined requirement.

11. The method according to claim 9, wherein the obtaining indication information indicating whether an area occupied by the character in the image block satisfies a predetermined requirement comprises:

in a case where the at least one image block is a plurality of image blocks, determining whether the area occupied by the character in each of the plurality of image blocks satisfies a preset requirement;

determining a proportion of image blocks with areas occupied by the character satisfying the preset requirement in the plurality of image blocks; and

if the proportion is greater than a preset proportion, generating indication information indicating that the area occupied by the character in the image block satisfies the predetermined requirement.

12. The method according to claim 11, wherein the method further comprises:

if the proportion is not greater than the preset proportion, generating indication information indicating that the area occupied by the character in the image block does not satisfy the predetermined requirement.

~~13. The method according to any one of claims 1 to 12, wherein~~

~~the neural network comprises: a shared neural network configured to extract an image feature, a first branch configured to output perspective transformation information of the image block, and a second branch configured to output image block rotation information indicating an integer multiple of 90 degrees, wherein an output end of the shared neural network is respectively connected to input ends of the first branch and the second branch.~~

13~~14~~. The method according to claim 1~~–13~~, wherein a neural network training process comprises:

obtaining, from a training data set, an image block sample having form transformation label information;

obtaining, on the basis of a neural network to be trained, image block sample form transformation information of the image block sample, the image block sample form transformation information being used for changing a character orientation in the image block sample to a predetermined orientation; and

performing supervised learning on the neural network to be trained by using form transformation label information of the image block sample as guidance information, so as to reduce an error between the image block sample form transformation information outputted by the neural network to be trained and the form transformation label information.

14~~15~~. The method according to claim 13~~–14~~, wherein the performing supervised learning on the neural network to be trained by using form transformation label information of the image block sample as guidance information, so as to reduce an error between the image block sample form transformation information outputted by the neural network to be trained and the form transformation label information comprises:

performing supervised learning on the shared neural network configured to extract an image feature and the first branch configured to output perspective transformation information of the image block sample in the neural network by using perspective transformation label information in the form transformation label information of the image block sample as guidance information, so as to reduce an error between the perspective transformation information of the image block sample outputted by the first branch and the perspective transformation label information of the image block sample; and

after trainings for the shared neural network and the first branch are completed, in a case where network parameters of the shared neural network and the first branch remain unchanged, performing supervised learning on the second branch configured to output image block sample rotation information indicating the integer multiple of 90 degrees in the neural network by using image block sample rotation label information indicating an integer multiple of 90 degrees in the form transformation label information as guidance information, so as to reduce an error between the image block sample rotation information indicating the integer multiple of 90 degrees outputted by the second branch and the image block sample rotation label information indicating the integer multiple of 90 degrees.

1516. The method according to claim 14 15, wherein the performing supervised learning on the neural network to be trained by using form transformation label information of the image block sample as guidance information, so as to reduce an error between the image block sample form transformation information outputted by the neural network to be trained and the form transformation label information further comprises:

after trainings for the shared neural network and the first branch are completed, in a case where network parameters of the shared neural network and the first branch remain unchanged, performing supervised learning on a third branch configured to output indication information indicating whether the area occupied by the character in the image block satisfies the predetermined requirement by using label information indicating whether the area occupied by the character in the image block satisfies the predetermined requirement in the form transformation label information as guidance information, so as to reduce an error between the indication information outputted by the third branch and the label information indicating whether the area occupied by the character in the image block satisfies the predetermined requirement.

1617. The method according to any one of claims 1 13 to 15 16, wherein the obtaining an image block sample having form transformation label information comprises:

performing form transformation processing on at least partial region of a character image sample with a character orientation being a predetermined orientation; and

determining the form transformation label information according to the form transformation processing.

1718. The method according to claim 16 17, wherein the performing form transformation processing on at least partial region of a character image sample with a character orientation being a predetermined orientation, and determining the form

transformation label information according to the form transformation processing comprises:

performing perspective transformation processing on the at least partial region of the character image sample with the character orientation being the predetermined orientation;

capturing, from the region subjected to perspective transformation processing, an image sample block with an area occupied by the character satisfying a predetermined requirement;

rotating the image sample block by a random integer multiple of 90 degrees;

determining, according to a perspective transformation matrix used in the perspective transformation processing, perspective transformation label information of the image sample block; and

determining, according to the rotation by the random integer multiple of 90 degrees, an image block sample rotation label information indicating an integer multiple of 90 degrees.

18~~19~~. An electronic device, comprising:

a memory, configured to store a computer program; and

a processor, configured to execute the computer program stored in the memory, wherein when the computer program is executed, the operations in the character image processing method according to any one of claims 1 to 17~~18~~ are implemented.

19~~20~~. A computer-readable storage medium having a computer program stored thereon, wherein when the computer program is executed by a processor, the operations in the character image processing method according to any one of claims 1 to 17~~18~~ are implemented.