Supplementary Information

Stretchable, ultralow detection limit and anti-interference hydrogel strain sensor for intelligent throat speech recognition using Resnet50 neural network

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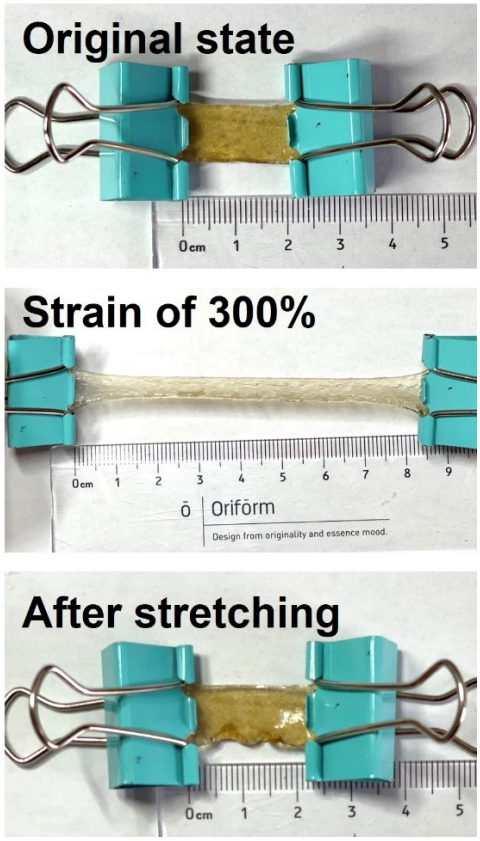

Fig. S1 The self-recovery ability of the hydrogel.

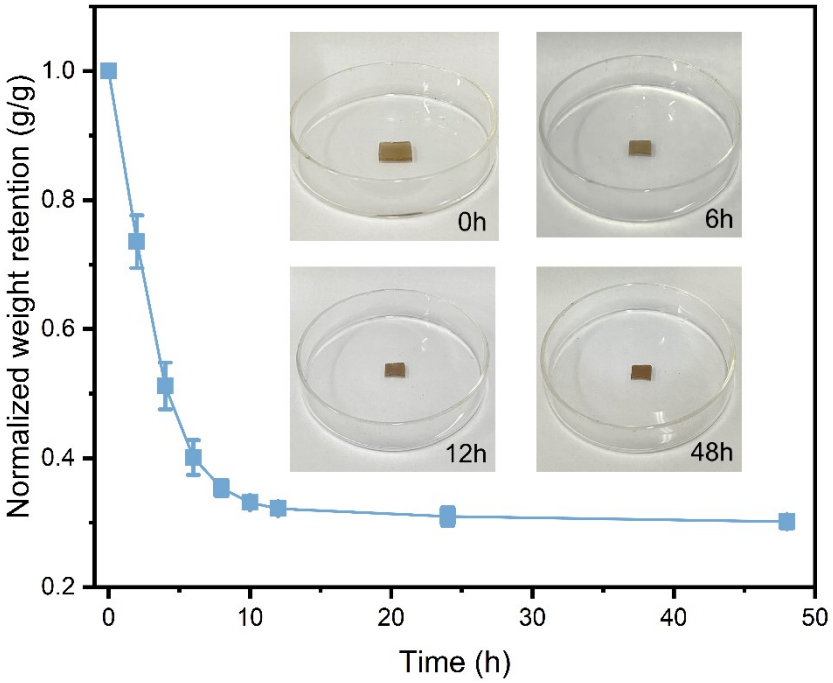

Fig. S2 Variation in hydrogel mass as a function of drying time.

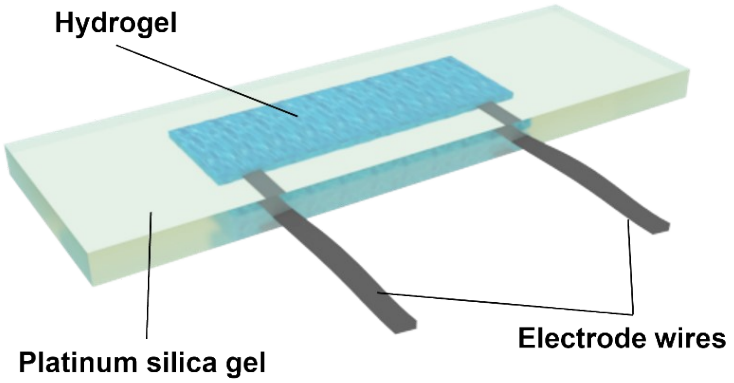

Fig. S3 Schematic illustration of the packaged strain sensor.

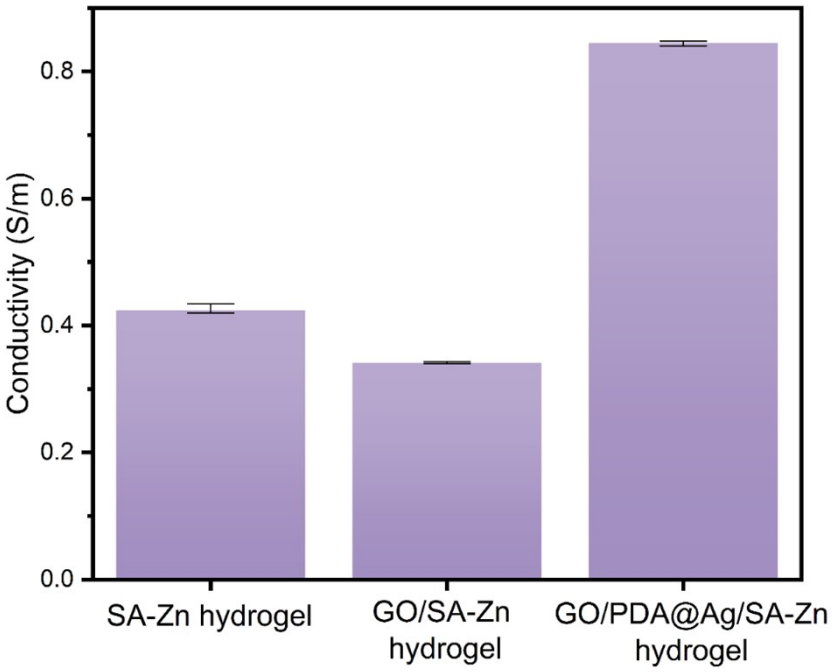

Fig. S4 The conductivity of different hydrogel samples.

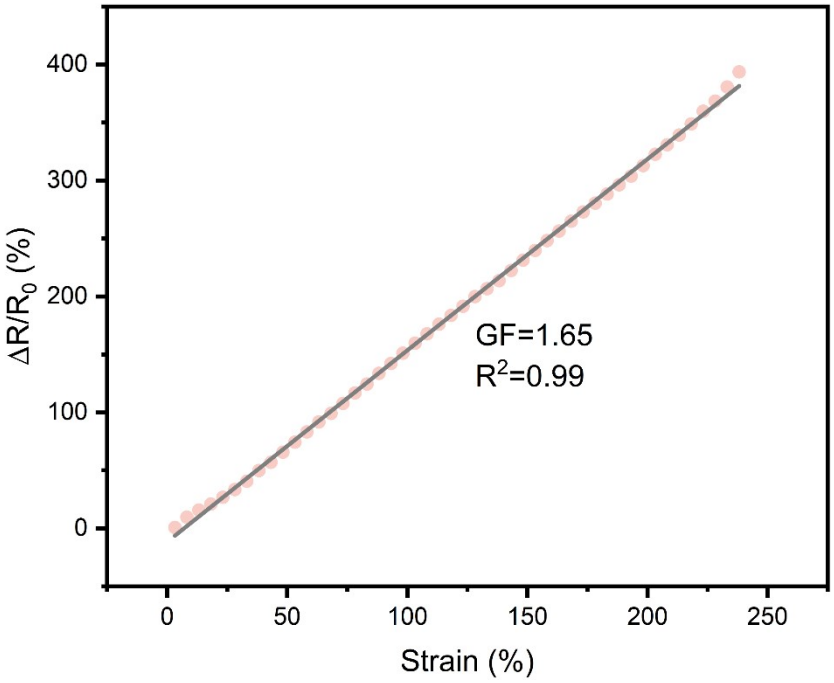

Fig. S5 Sensitivity of SA-Zn hydrogel.

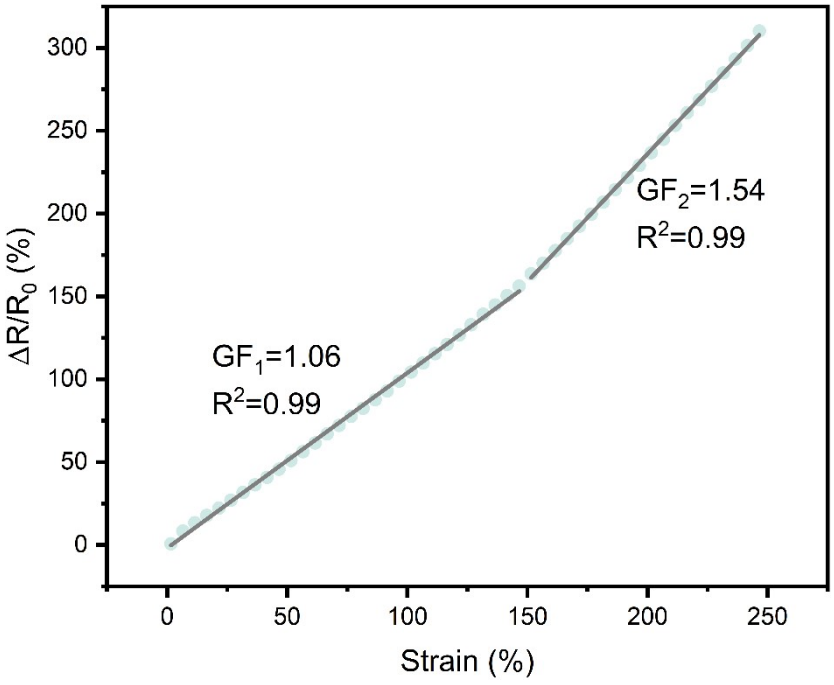

Fig. S6 Sensitivity of GO/SA-Zn hydrogel.

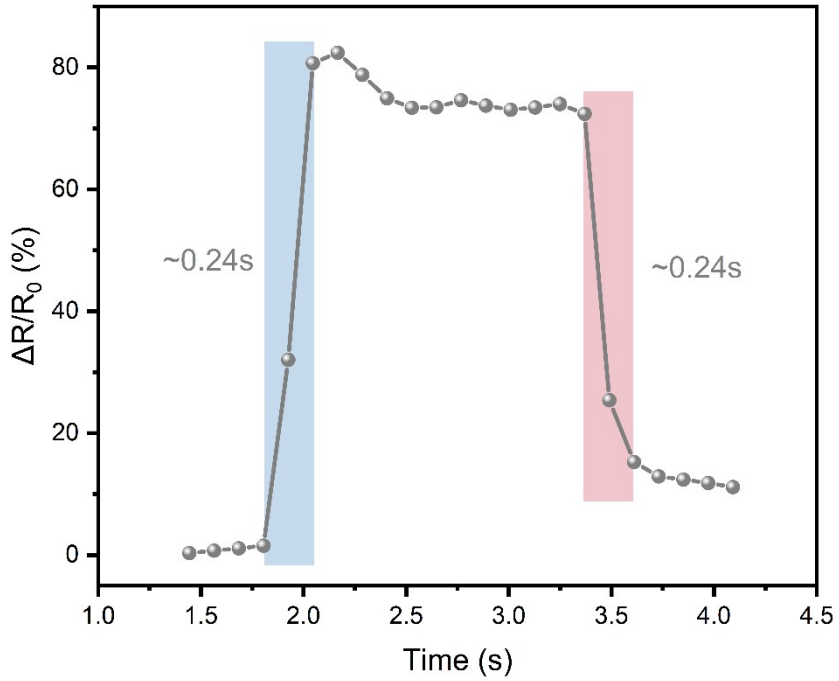

Fig. S7 Response time and recovery time of the sensor.

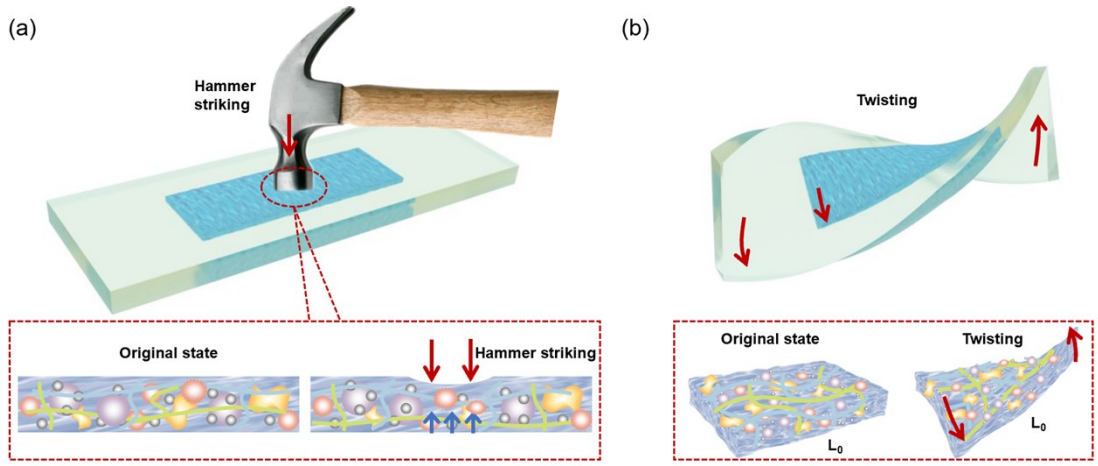

Fig. S8 Schematic diagram of internal changes in hydrogel under (a)hammer striking, and (b) twisting.

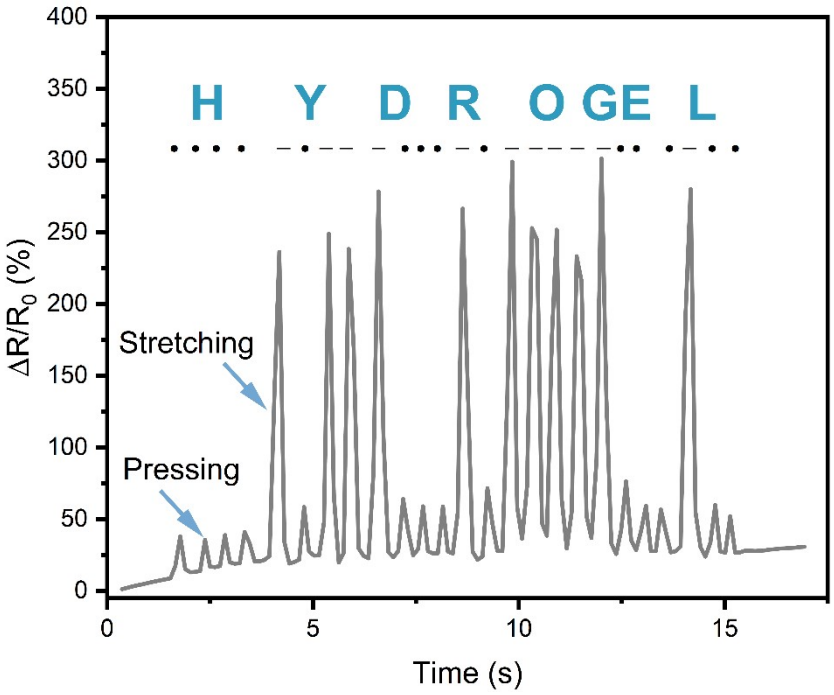

Fig. S9 Application for Morse code (“Hydrogel”) message transmission.

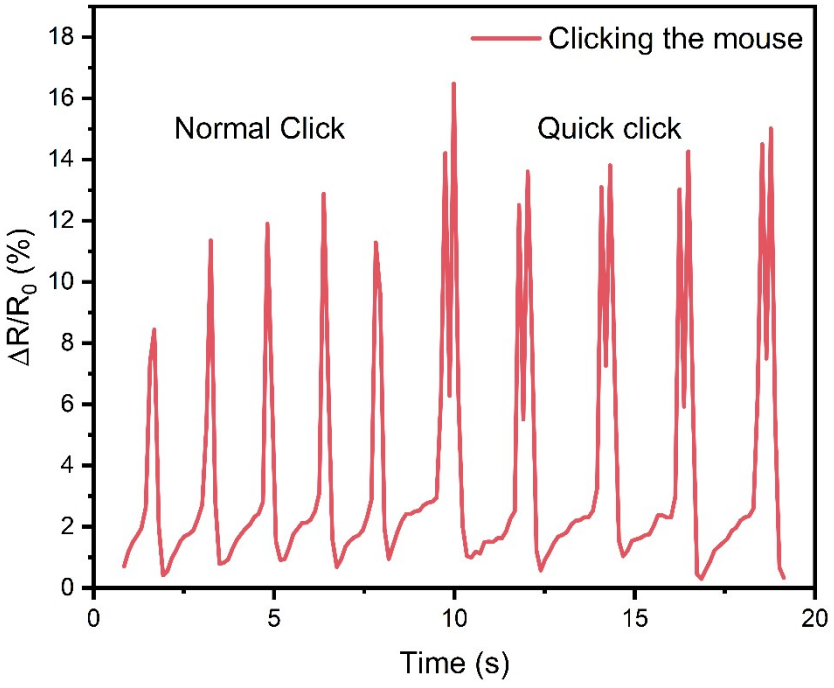

Fig. S10 Application for normal and quick clicking.

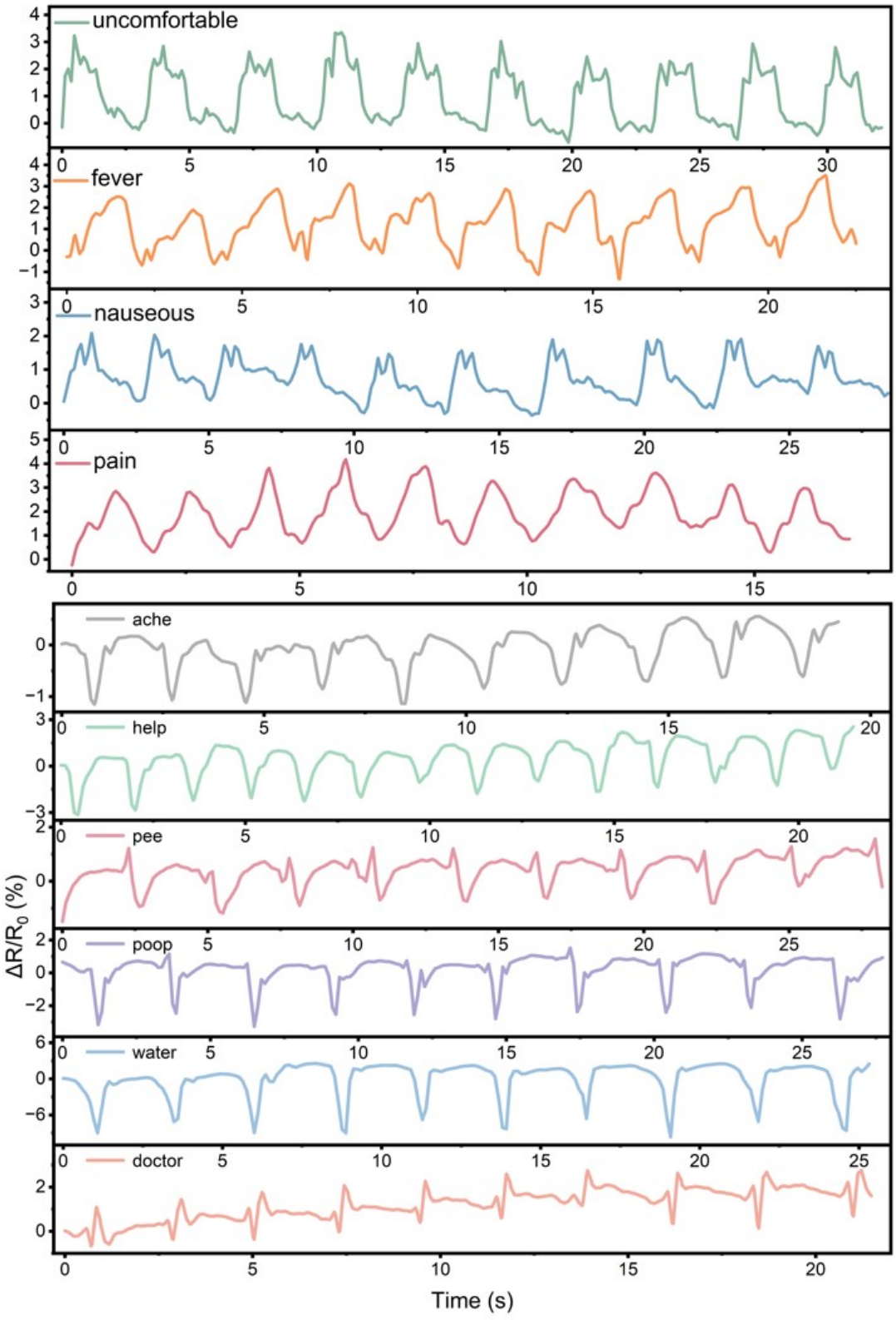

Fig. S11 The relative resistance of ten repetitions corresponds to ten kinds of words.

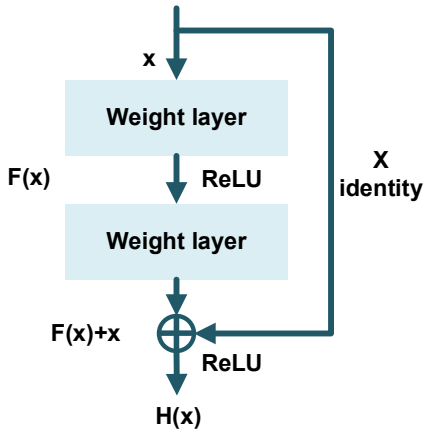

Fig. S12 The building block of residual learning.

As shown in Figure S11, x represents the input of the residual unit, F(x) represents the residual value of the input after the convolution layer, H(x) represents the output of the current residual unit, and its expression is as follows:

$$H(x)=F(x)+x$$

When the network training reaches a relatively saturated accuracy rate, the next learning process is equivalent to identity mapping learning, that is, H(x)=x, and the subsequent training goal becomes to make the residual F(x) approach 0. As the network deepens, the accuracy rate no longer decreases.

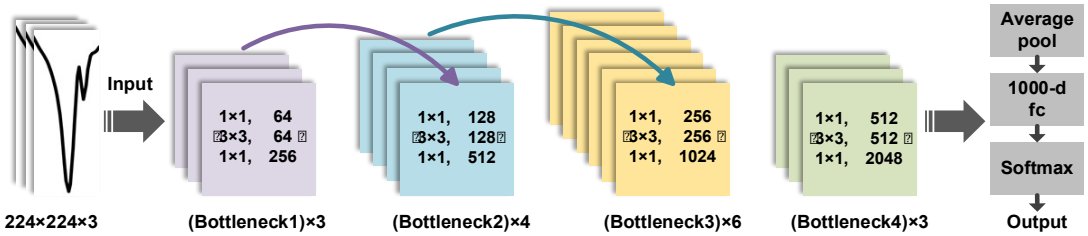

Fig. S13 The principle of the Resnet50 algorithm.

Fig S13 shows the parameter migration of the ResNet50 pre-trained model. The bottleneck is the basic unit of ResNet50. Each Bottleneck residual block is composed of three convolution layers. 1×1 convolution is used to reduce the input channel, and then 1×1 convolution is used to recover to reduce the amount of calculation. The input data is obtained after three convolutions. The output data is added to the input to obtain the final output of the residual block.