AN EFFICIENT DEEP NEURAL NETWORKS TRAINING FRAMEWORK FOR ROBUST FACE RECOGNITION

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Introduction
We propose an efficient deep neural networks training framework for face recognition. The framework contains two stages:

- The DNN initialization. A deep architecture based on the softmax loss function is designed to initialize the DNN.
- The adaptive fine-tuning. The formulation is described as follow.

\[ \text{Loss} = \sum_{i=1}^{N} \max(\text{err}(S_i), 0) \]

\[ \text{err}(S_i) = \frac{D_{S_i} + \frac{D_{S_i}}{D_N}}{2} - D_{an} \]

The completed method

Algorithm 1: An Efficient DNN Training Framework

**Input:** Training dataset \( S \), sampling interval \( K \), and maximal epoch \( T \)

**Output:** The trained network parameters \( W \)

1. Initialization: Randomize \( W \), \( T = 0, 1, 2 \ldots \)

2. while not converge do
   3. for each training sample \( x_i \in S \) do
      4. Forward pass to obtain the face representation;
      5. Backpropagation to update the network parameters \( W \) via the original softmax.
   6. end
   7. end

8. while \( r < T \) do
   9. if \( r \mod 0 \) then
      10. Generate triplet samples \( \{x_1, x_2, x_3\} \) according the current model parameters \( W \).
      11. Select the negative sample \( x_2 \) via Eq. (2);
      12. \( T = T + 1 \)
      13. end
      14. for each triplet sample \( \{x_1, x_2, x_3\} \in T \) do
      15. Forward pass to obtain the face representation;
      16. Backpropagation to update the network parameters \( W \) via Eq. (1);
      17. end
   18. \( r = r + 1 \); end

Conclusions
- In this paper, a novel DNN training framework, which takes advantage of both the softmax loss and triplet loss functions, has been proposed for efficient face recognition.
- A specific softmax loss-based DNN architecture is designed to initialize the DNN. Based on it, we improve the discrimination capability of the DNN with a triplet loss function, where an adaptive margin is adopted.
- We have verified the effectiveness of the proposed DNN training framework on the LFW dataset and four different face datasets.

References

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