Robust Memory-augmented Neural Network for Few-shot Learning Application

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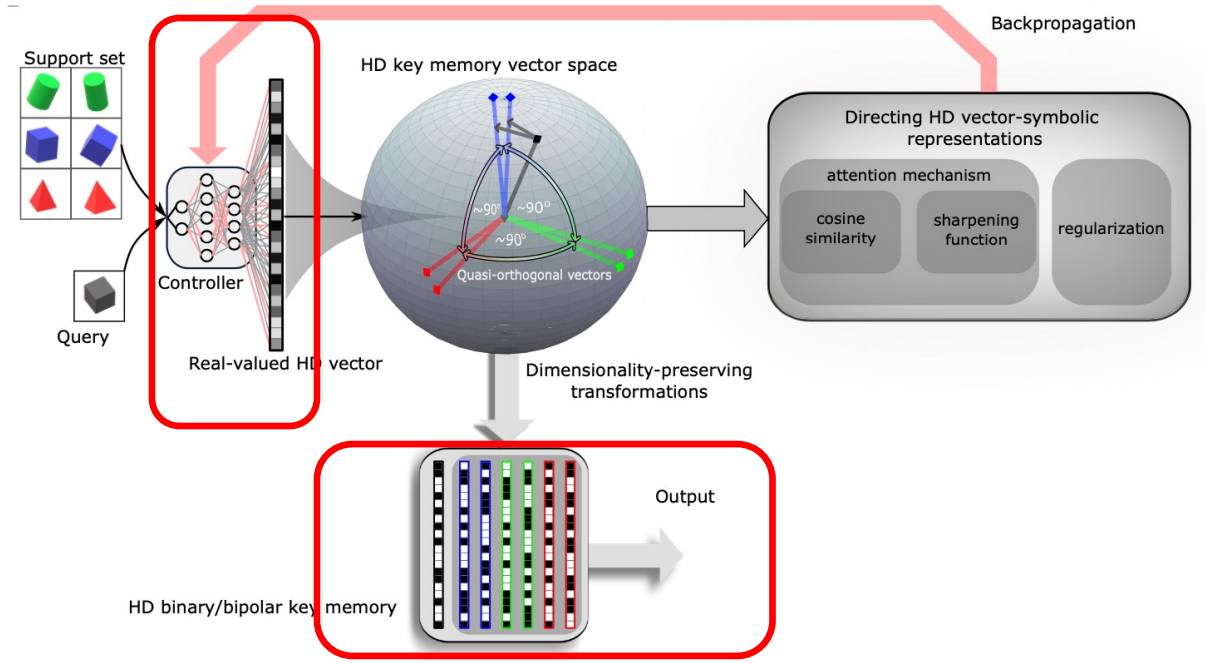
Target

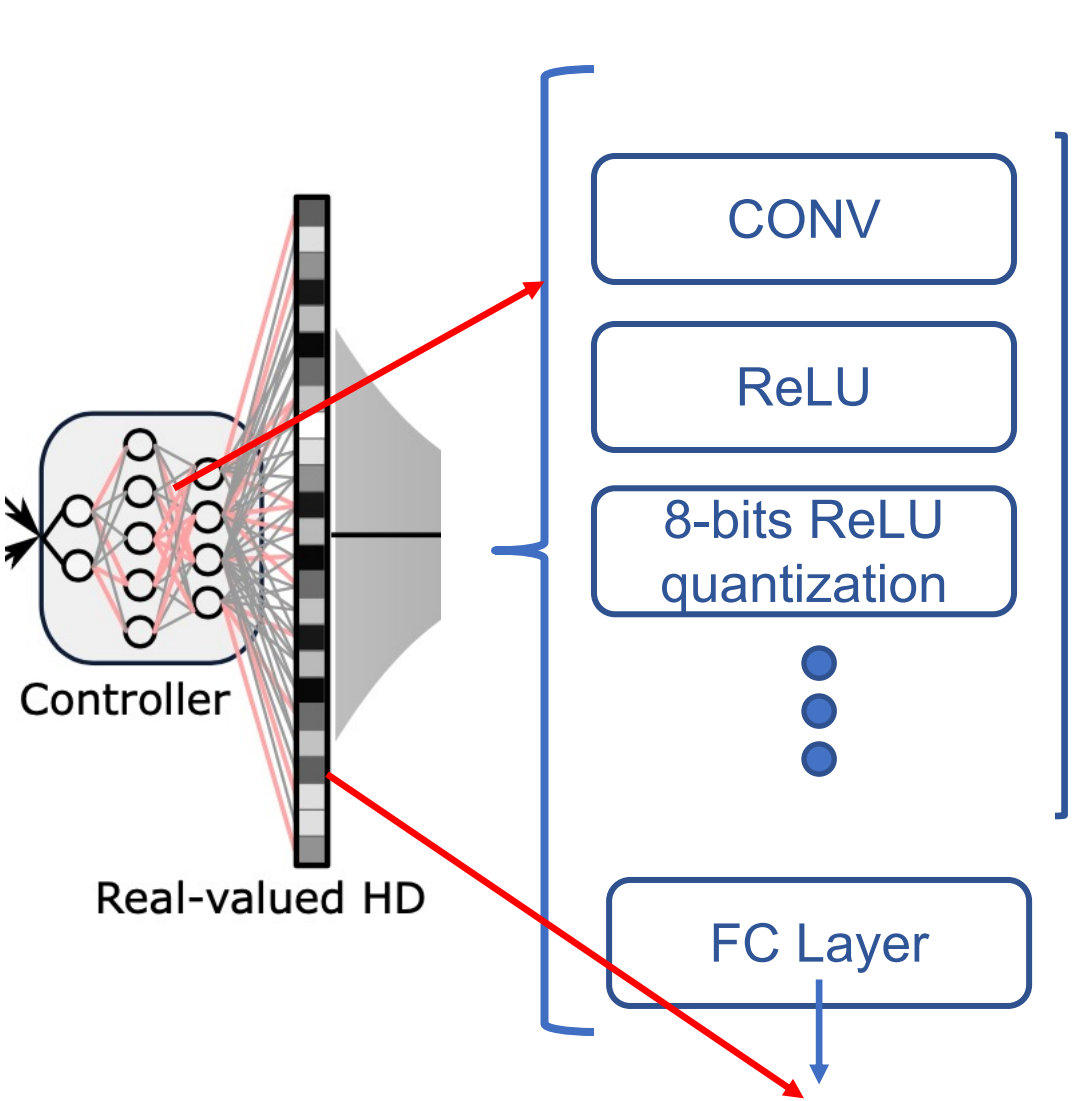
- Check out the noise effect of controller to the accuracy of 5-ways 1-shot application
- Simulate In-memory computing non-ideal effect on hardware

Memory-augmented Neural Network

- Support set become a key memory after propagating through controller.
- Similarly, the query set become HD vectors and the output is decided after the In-memory searching.

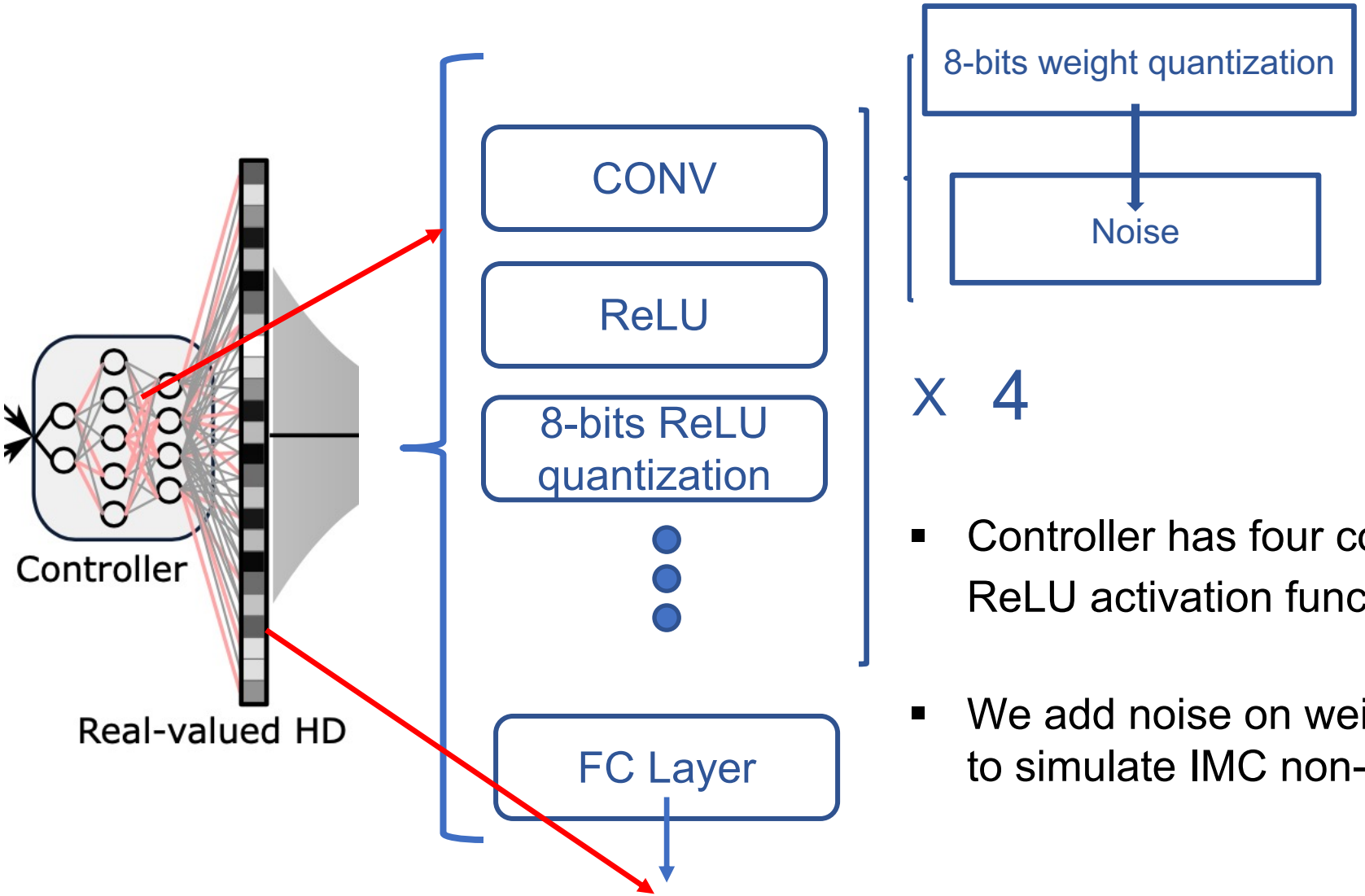


Network Architecture of the Controller (1/2)



- Controller has four convolutional layers and ReLU activation functions.

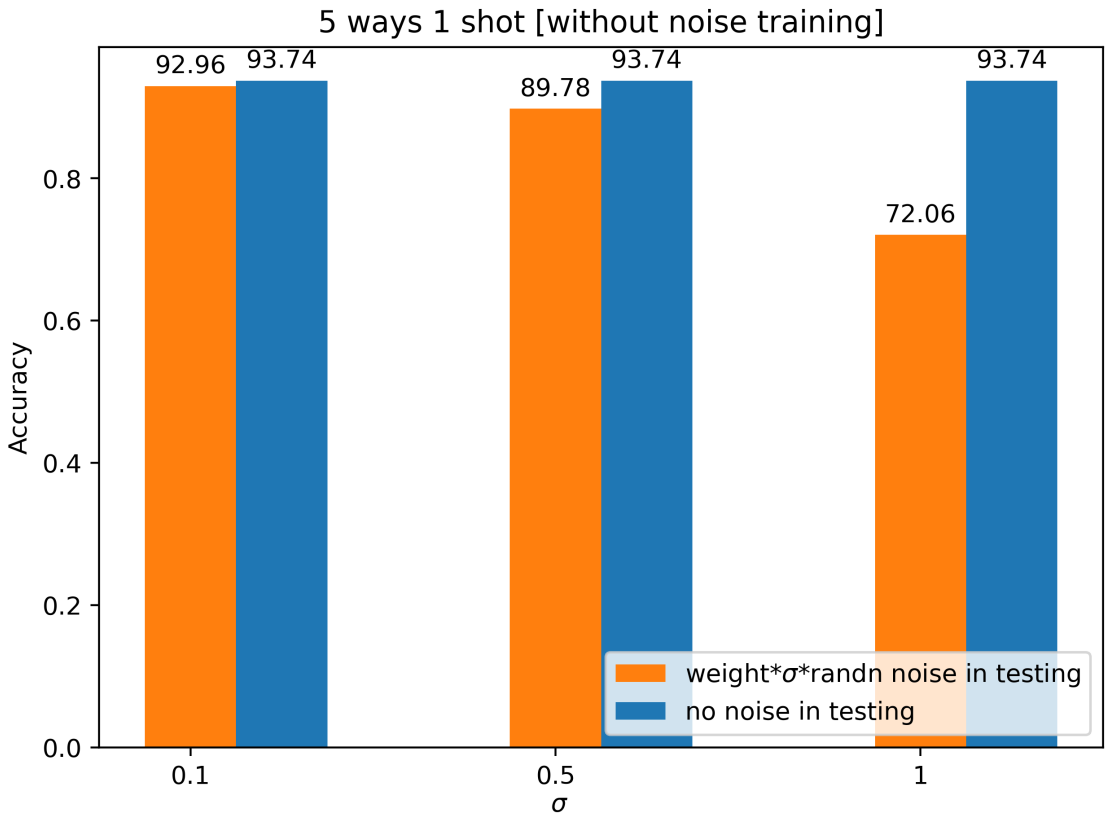
Network Architecture of the Controller (1/2)



- Controller has four convolutional layers and ReLU activation functions.
- We add noise on weight of convolutional layers to simulate IMC non-ideal effect.

Experiment 1: training without noise (1/2)

- Average accuracy of different noise
  - Noise is applied only on testing stage



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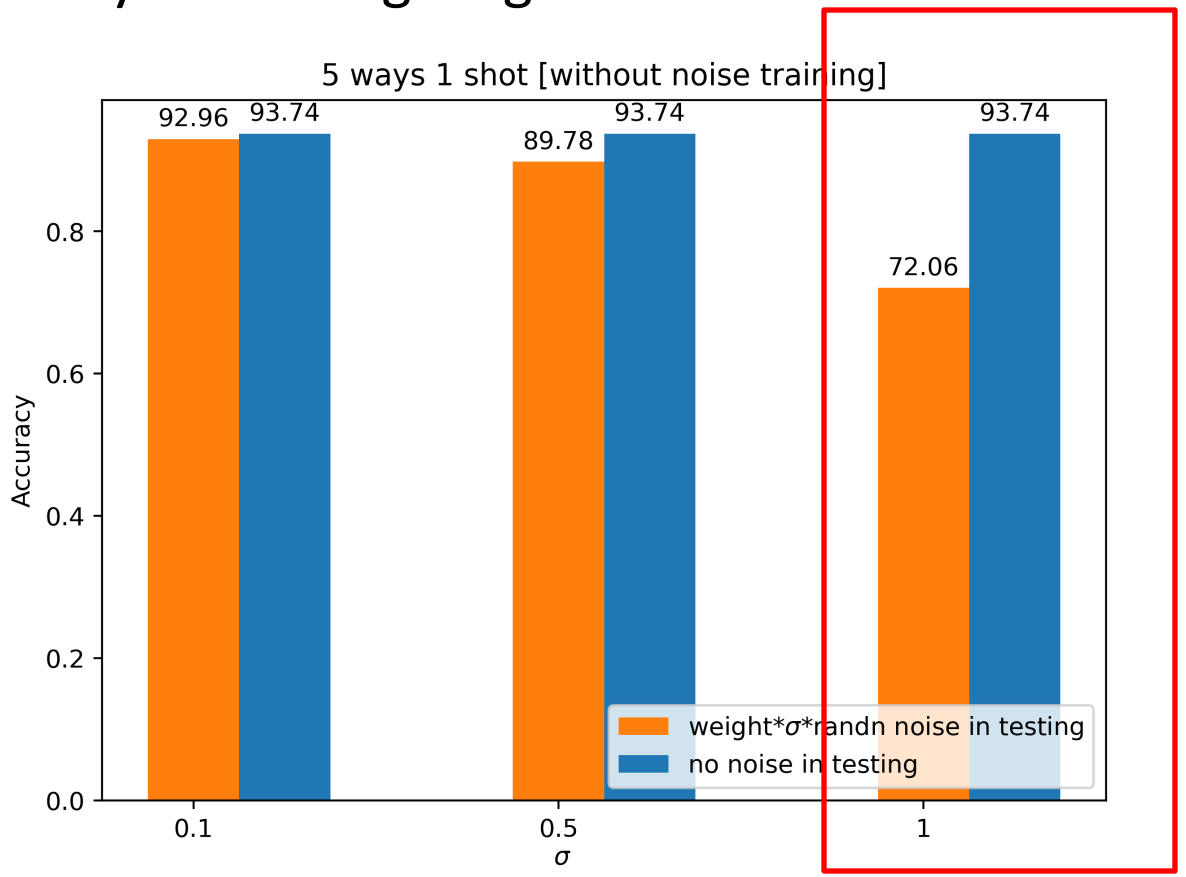
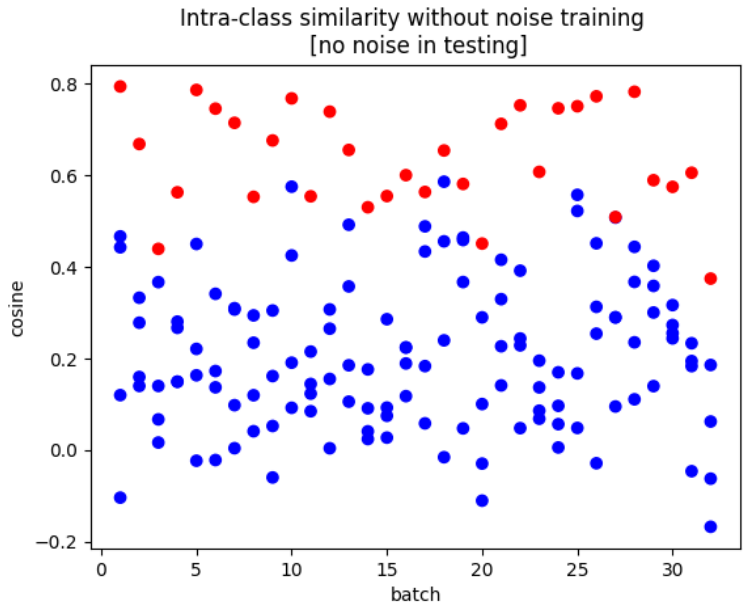
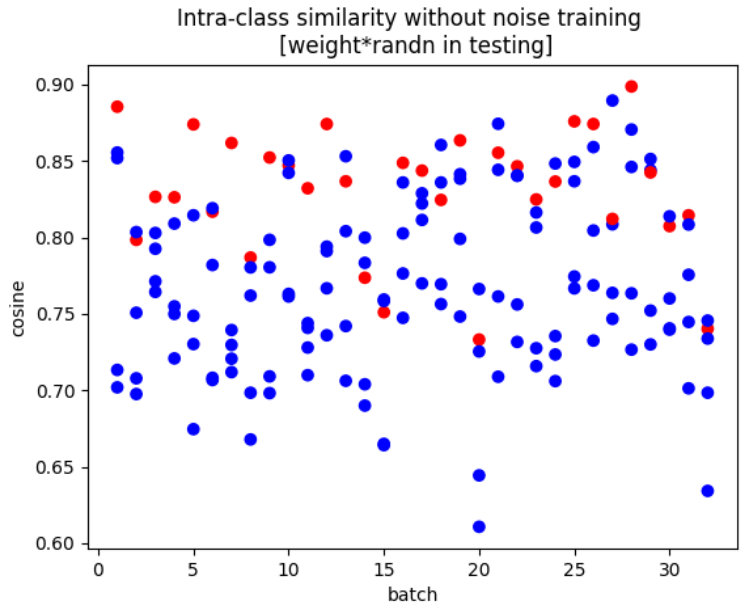


Experiment 1: training without noise (2/2)

- Intra-class similarity of query memory and key memory
  - : similarity of the target label
  - : similarity of the non-target label





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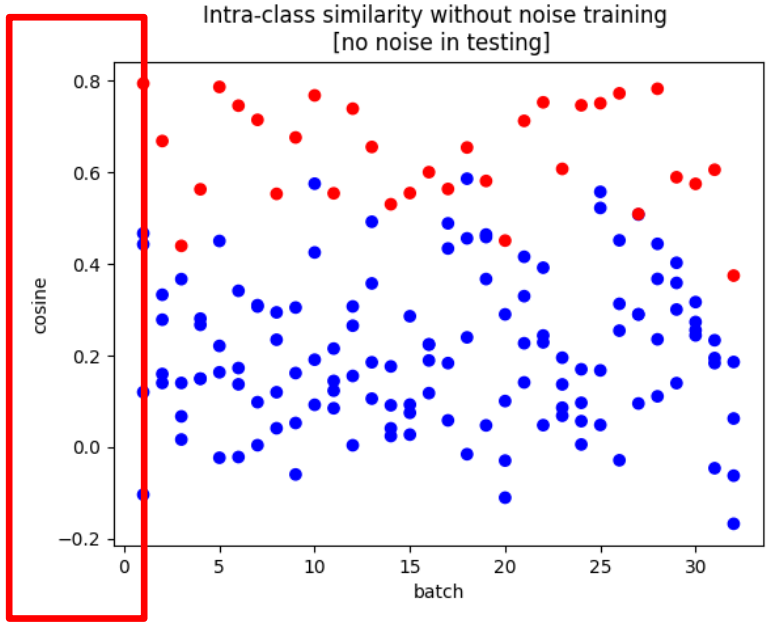
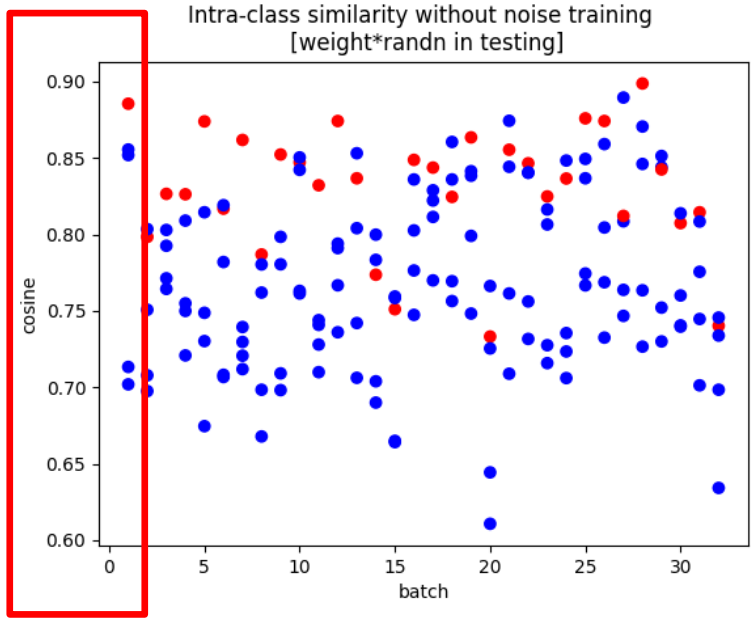
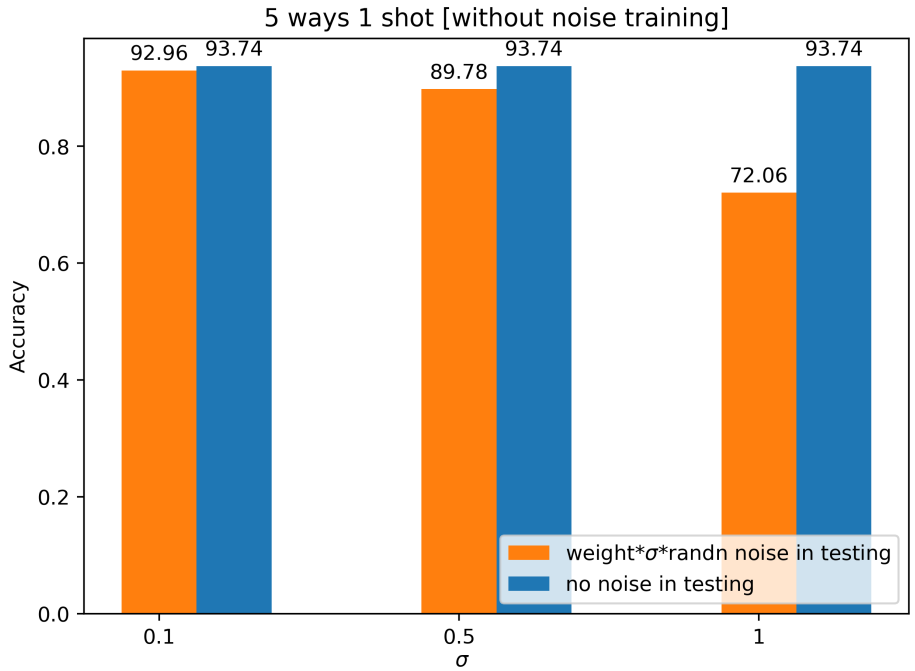


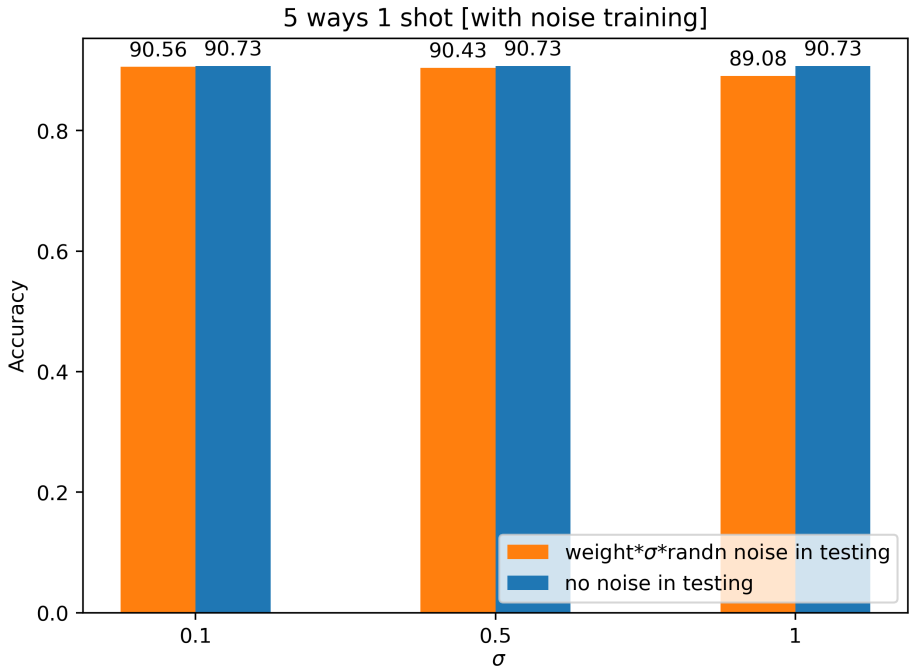
Non-target and target all have high similarity => ambiguous



Experiment 2: training with noise (1/2)

- Average accuracy of different noise
  - Left : training without noise
  - Right : training with standard noise





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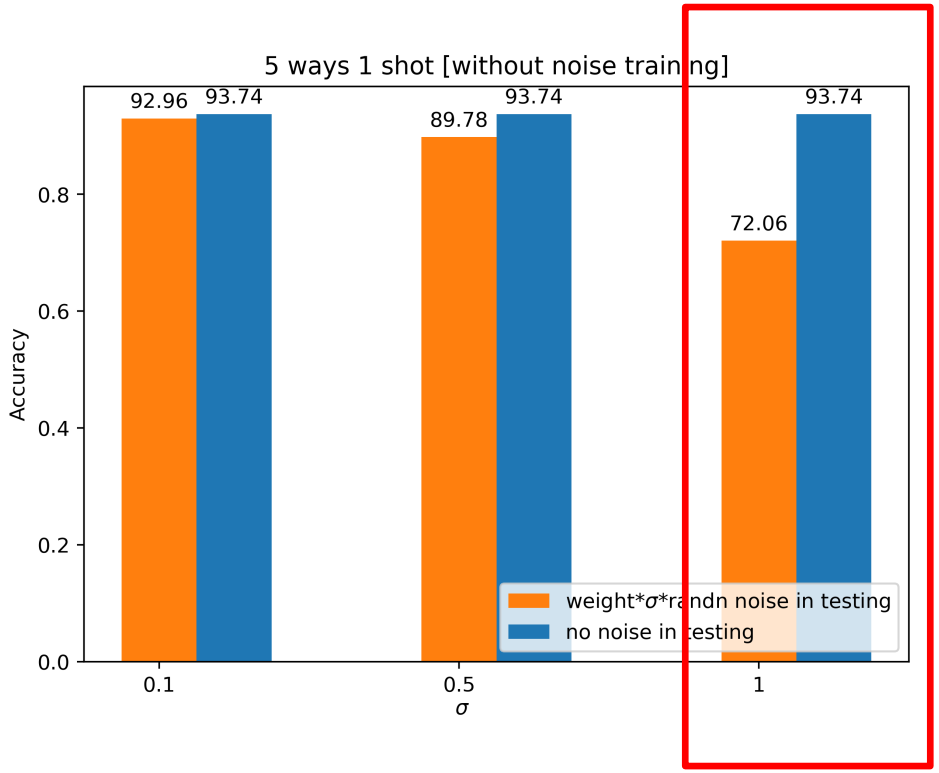
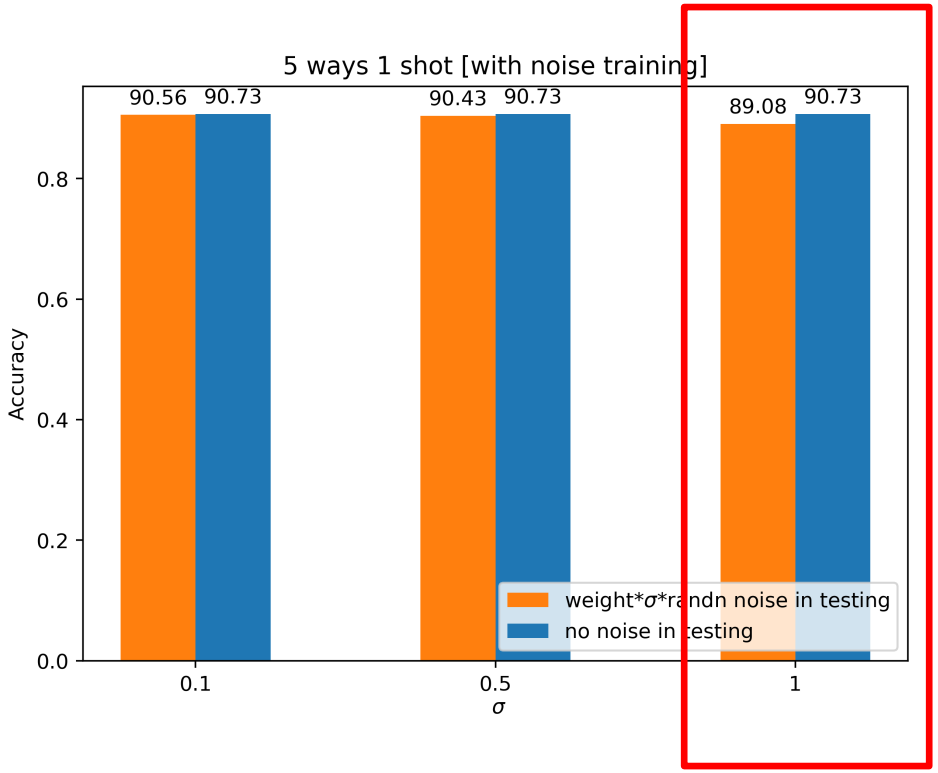
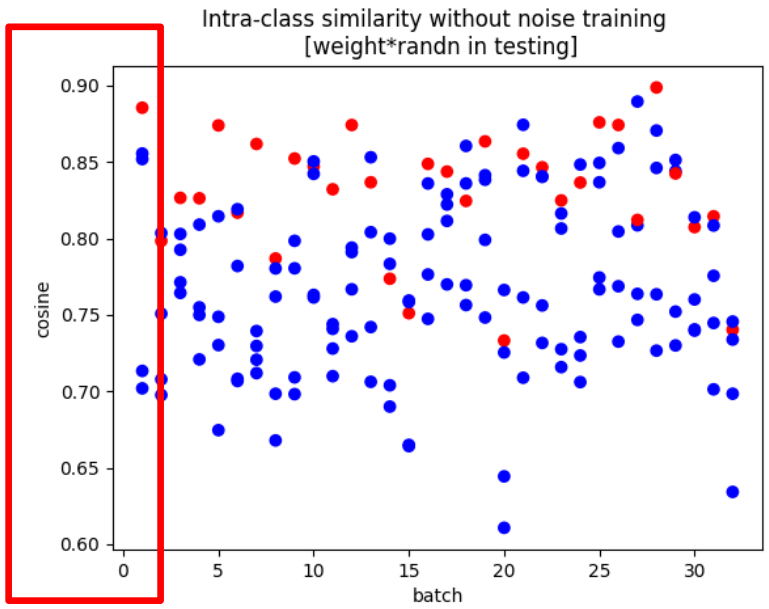


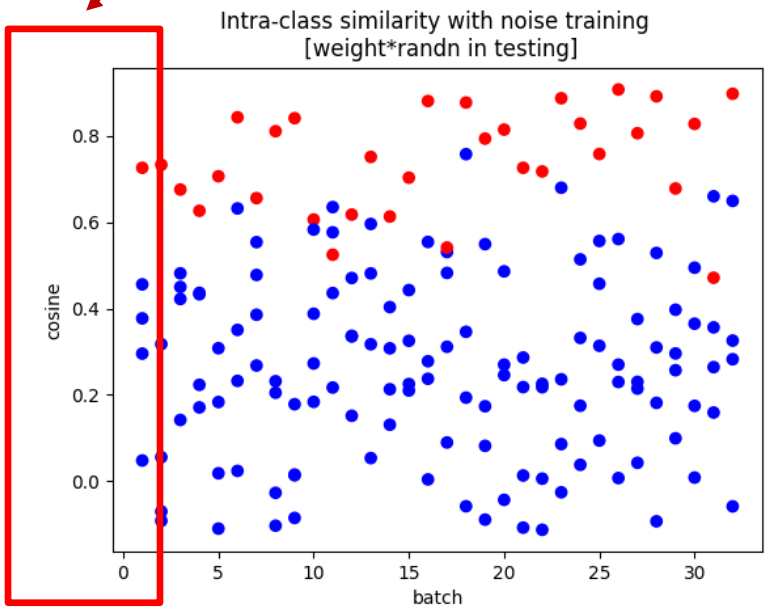


Experiment 2: training with noise (2/2)

- Intra-class similarity of query memory and key memory
  - Left : training without noise
  - Right : training with standard noise

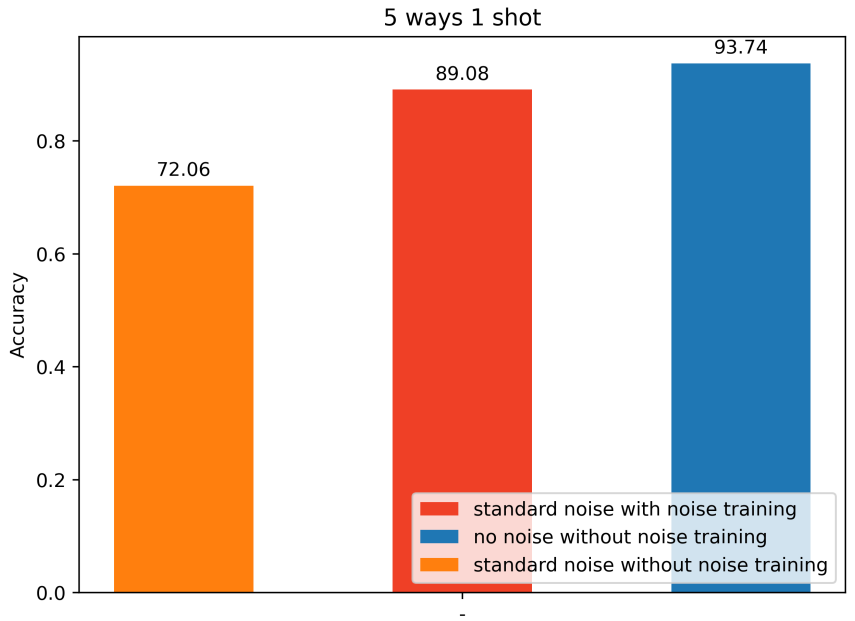


There is more similarity difference between target and non-target



Conclusion

- Although the accuracy of model trained with standard noise drops about 4.66% compared to the model trained without noise, it remains robustness to different variance of noise.



Thanks for your listening !