Few-Shot Class-Incremental Learning from an Open-Set Perspective

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1 Introduction

In the supplementary material, we present more details about the experiments in our paper. The detailed average accuracy and harmonic accuracy values are reported in the tables. Following the CEC paper [7], we also report on the performance dropping rate (PD). The PD measures the absolute accuracy decrease between the base learning and the last incremental session.

2 Detailed Results
Table 1: Experimental results for the 8-step 5-way 5-shot FSCIL protocol on the CIFAR100 dataset. The performance dropping rate (PD) measures the absolute accuracy decrease between the base learning and the last incremental session. The * indicates results reported in [7,6] and the ‡ indicates results from our implementation using the official published code.

| Method     | 0   | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | PD ▼ |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| Ft-CNN     | 64.1| 36.9| 15.4| 9.8 | 6.7 | 3.8 | 3.7 | 3.1 | 2.7 | 61.4 |
| iCaRL [5]  | 64.1| 53.3| 41.7| 34.1| 27.9| 25.1| 20.4| 15.5| 13.7| 50.4 |
| EEIL [1]   | 64.1| 53.1| 43.7| 35.2| 29.0| 25.0| 21.0| 17.3| 15.9| 48.2 |
| NCM [4]    | 64.1| 53.1| 44.0| 37.0| 31.6| 26.7| 21.2| 16.8| 13.5| 40.6 |
| TOPIC [6]  | 64.1| 55.9| 47.1| 45.2| 40.1| 36.4| 34.0| 31.6| 29.4| 34.7 |
| CEC [7]    | 73.1| 68.9| 65.3| 61.2| 55.6| 53.2| 51.6| 49.1| 24.0|      |
| CEC ‡ [7]  | 74.0| 68.1| 64.2| 60.6| 57.3| 54.8| 52.5| 50.3| 48.1| 25.9 |
| ALICE (Ours)| 79.0| 70.5| 67.1| 63.4| 61.2| 59.2| 58.1| 56.3| 54.1| 24.9 |
| harmonic accuracy |      |     |     |     |     |     |     |     |     |      |
| CEC [7]    | -   | 40.2| 37.6| 34.9| 32.9| 33.6| 33.1| 31.9| 31.3| -    |
| ALICE (Ours)| -   | 65.3| 62.3| 55.7| 54.5| 54.0| 53.9| 52.1| 50.6| -    |

Table 2: Experimental results for the 8-step 5-way 5-shot FSCIL protocol on the miniImageNet dataset.

| Method     | 0   | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | PD ▼ |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| Ft-CNN     | 61.3| 27.2| 16.4| 6.1 | 2.5 | 1.6 | 1.9 | 2.6 | 1.4 | 59.9 |
| iCaRL [5]  | 61.3| 46.3| 42.9| 37.6| 30.5| 24.0| 20.9| 18.8| 17.2| 44.1 |
| EEIL [1]   | 61.3| 46.6| 44.0| 37.3| 33.1| 27.1| 24.1| 21.6| 19.6| 41.7 |
| NCM [4]    | 61.3| 47.8| 39.3| 31.9| 26.7| 21.4| 18.7| 17.2| 14.2| 47.1 |
| TOPIC [6]  | 61.3| 50.1| 45.2| 41.2| 37.5| 35.5| 32.2| 29.5| 24.4| 36.9 |
| CEC [7]    | 72.0| 66.8| 63.9| 59.4| 56.7| 53.7| 51.2| 49.2| 47.6| 24.4 |
| CEC ‡ [7]  | 71.2| 66.0| 61.9| 58.6| 56.4| 53.4| 50.7| 48.8| 47.2| 24.0 |
| ALICE (Ours)| 80.6| 70.6| 67.4| 64.5| 62.5| 60.0| 57.8| 56.8| 55.7| 24.9 |
| harmonic accuracy |      |     |     |     |     |     |     |     |     |      |
| CEC [7]    | -   | 34.6| 31.0| 29.0| 31.8| 28.9| 26.9| 27.5| 28.1| -    |
| ALICE (Ours)| -   | 64.9| 58.9| 56.4| 55.4| 52.7| 50.8| 51.0| 50.9| -    |

Table 3: Experimental results for the 10-step 10-way 5-shot FSCIL protocol on the CUB200 dataset.

| Method     | 0   | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  | PD ▼ |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| Ft-CNN     | 68.7| 43.7| 25.1| 17.7| 18.1| 17.0| 15.1| 10.6| 8.9 | 8.9 | 8.5 | 60.2 |
| iCaRL [5]  | 68.7| 52.7| 47.7| 44.2| 36.6| 29.5| 27.8| 26.3| 24.0| 23.9| 21.2| 47.5 |
| EEIL [1]   | 68.7| 53.6| 47.9| 44.2| 36.3| 27.5| 25.9| 24.7| 24.0| 24.1| 22.1| 46.6 |
| NCM [4]    | 68.7| 57.1| 44.2| 28.8| 26.7| 25.7| 24.6| 23.5| 22.3| 20.1| 19.5| 48.8 |
| TOPIC [6]  | 68.7| 62.5| 54.8| 39.0| 43.3| 41.4| 38.4| 35.4| 32.2| 28.3| 26.1| 32.1 |
| Cheraghian et al. [2] | 68.2| 60.5| 55.7| 50.6| 45.7| 42.9| 40.9| 38.8| 36.5| 34.9| 33.9| 35.2 |
| Cheraghian et al. [3] | 68.8| 59.4| 53.4| 55.0| 52.9| 48.8| 48.1| 46.3| 44.3| 43.4| 43.2| 25.6 |
| CEC [7]    | 75.9| 71.9| 68.5| 63.5| 62.4| 58.3| 57.7| 55.8| 54.8| 53.5| 52.1| 23.6 |
| CEC ‡ [7]  | 76.0| 71.3| 67.3| 63.5| 61.5| 58.3| 56.3| 54.0| 52.2| 49.9| 50.7| 24.3 |
| ALICE (Ours)| 77.4| 72.7| 70.6| 67.2| 65.9| 63.4| 62.9| 61.9| 60.5| 60.6| 60.1| 17.3 |
| harmonic accuracy |     |     |     |     |     |     |     |     |     |     |     |      |
| CEC [7]    | -   | 59.6| 52.6| 46.6| 48.1| 45.9| 44.7| 44.4| 42.3| 42.3| 43.9| -    |
| ALICE (Ours)| -   | 70.0| 65.6| 59.3| 59.6| 57.6| 58.9| 58.8| 57.8| 58.8| 59.0| -    |
Table 4: Experimental results for the 8-step 5-way 1-shot FSCIL protocol on the CIFAR100 dataset.

|       | 0   | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | PD ↓ |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| CEC[7] | 74.0 | 67.3 | 62.6 | 59.0 | 55.3 | 52.1 | 49.5 | 47.0 | 44.8 | 29.2 |
| ALICE (Ours) | **79.0** | **71.0** | **66.4** | **62.2** | **58.1** | **54.7** | **52.0** | **49.8** | **47.5** | **31.5** |

harmonic accuracy

|       | 0   | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | -    |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| CEC[7] | -   | 12.1 | 11.4 | 14.3 | 13.4 | 13.1 | 13.7 | 13.3 | 13.0 | -    |
| ALICE (Ours) | -   | **35.7** | **33.9** | **33.0** | **29.2** | **28.2** | **27.6** | **27.3** | **26.5** | -    |

Table 5: Experimental results for the 8-step 5-way 1-shot FSCIL protocol on the miniImageNet dataset.

|       | 0   | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | PD ↓ |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| CEC[7] | 71.2 | 66.3 | 61.6 | 57.6 | 54.0 | 50.8 | 48.2 | 45.9 | 43.7 | **27.5** |
| ALICE (Ours) | **80.0** | **70.7** | **65.8** | **61.8** | **58.4** | **55.3** | **52.4** | **50.7** | **48.6** | **32.0** |

harmonic accuracy

|       | 0   | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | -    |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| CEC[7] | -   | 9.0  | 7.9  | 7.3  | 6.7  | 6.0  | 6.4  | 7.2  | 7.8  | -    |
| ALICE (Ours) | -   | **35.2** | **25.2** | **24.5** | **26.0** | **25.3** | **23.9** | **26.8** | **27.1** | -    |

Table 6: Experimental results for the 10-step 10-way 1-shot FSCIL protocol on the CUB200 dataset.

|       | 0   | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  | PD ↓ |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| CEC[7] | 75.0 | **69.5** | **64.9** | **59.9** | **57.0** | **53.1** | **50.7** | **48.0** | **46.0** | **44.8** | **43.0** | **32.0** |
| ALICE (Ours) | **77.4** | **66.7** | **62.7** | **58.6** | **55.3** | **53.1** | **50.9** | **49.3** | **47.1** | **46.9** | **45.7** | **31.7** |

harmonic accuracy

|       | 0   | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  | -    |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| CEC[7] | -   | 32.5 | 31.8 | 24.8 | 27.2 | 25.5 | 25.4 | 24.5 | 24.3 | 26.0 | 25.5 | -    |
| ALICE (Ours) | -   | **40.8** | **38.4** | **33.4** | **33.0** | **33.9** | **33.8** | **34.9** | **33.2** | **36.3** | **36.3** | -    |
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