|  |  |  |
| --- | --- | --- |
|  | With normalization | Without normalization |
| With filter | **0.9289** | 0.9218 |
| Without filter | 0.9234 | 0.9140 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Delayinference** | **Delayonline training** | **Total SRAM consumption** | **Overall accuracy before/after online training**  **(On Dev Board)** | **Overall accuracy before/after online training**  **(Using PyTorch on PC)** |
| **QVAR** | 70.3 ms | 5.9 ms | 246.9KiB | 0.6885/0.8582 | 0.6979/0.8666 |
| **Ultrasonic** | 34.6 ms | 2.2 ms | 107.1KiB | 0.9301/0.9560 | 0.9232/0.9580 |

\*The Cortex M7 core works at 216MHz

\*Raw data are used in QVAR dataset

›

Ultra:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **On MCU** | | **On PC using PyTorch** | |
| **Acc before online training** | **Acc after online training** | **Acc before online training** | **Acc after online training** |
| Fold-0 | 0.9646 | 0.9771 | 0.9646 | 0.9771 |
| Fold-1 | 0.9083 | 0.9438 | 0.9083 | 0.9417 |
| Fold-2 | 0.9042 | 0.9396 | 0.9042 | 0.9396 |
| Fold-3 | 0.9042 | 0.9729 | 0.9042 | 0.9729 |
| Fold-4 | 0.8958 | 0.9333 | 0.8958 | 0.9333 |
| Fold-5 | 0.9583 | 0.9604 | 0.9583 | 0.9604 |
| Fold-6 | 0.9750 | 0.9938 | 0.9750 | 0.9938 |
| Mean | 0.9301 | 0.9601 | 0.9301 | 0.9598 |

QVAR:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **On MCU** | | **On PC using PyTorch** | |
| **Acc before online training** | **Acc after online training** | **Acc before online training** | **Acc after online training** |
| Fold-1 | 0.7419 | 0.9731 | 0.7419 | 0.9731 |
| Fold-2 | 0.8629 | 0.9371 | 0.8686 | 0.9371 |
| Fold-3 | 0.5955 | 0.8708 | 0.5955 | 0.8708 |
| Fold-4 | 0.3290 | 0.6774 | 0.3290 | 0.6774 |
| Fold-5 | 0.5000 | 0.8103 | 0.5000 | 0.8103 |
| Fold-6 | 0.5667 | 0.8167 | 0.5667 | 0.8167 |
| Fold-7 | 0.6552 | 0.8046 | 0.6552 | 0.8046 |
| Fold-8 | 0.8889 | 0.9722 | 0.8889 | 0.9722 |
| Fold-9 | 0.8667 | 0.9394 | 0.8667 | 0.9394 |
| Fold-10 | 0.5266 | 0.8757 | 0.5266 | 0.8757 |
| Fold-11 | 0.8876 | 0.9326 | 0.8876 | 0.9326 |
| Fold-12 | 0.8556 | 0.9222 | 0.8556 | 0.9222 |
| Fold-13 | 0.8352 | 0.8920 | 0.8352 | 0.8920 |
| Fold-14 | 0.8571 | 0.8743 | 0.8571 | 0.8743 |
| Fold-15 | 0.8820 | 0.9551 | 0.8820 | 0.9551 |
| Fold-16 | 0.5706 | 0.8249 | 0.5706 | 0.8249 |
| Fold-17 | 0.3712 | 0.6515 | 0.3712 | 0.6515 |
| Fold-18 | 0.4944 | 0.8090 | 0.4944 | 0.8090 |
| Fold-19 | 0.6149 | 0.7356 | 0.6149 | 0.7414 |
| Fold-20 | 0.7614 | 0.8864 | 0.7614 | 0.8864 |
| Mean | 0.6835 | 0.8580 | 0.6835 | 0.8583 |

Gym:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **On MCU** | | **On PC using PyTorch** | |
| **Acc before online training** | **Acc after online training** | **Acc before online training** | **Acc after online training** |
| Fold-1 | 0.9004 | 0.9278 | 0.9004 | 0.9278 |
| Fold-2 | 0.8701 | 0.8813 | 0.8701 | 0.8799 |
| Fold-3 | 0.9233 | 0.9444 | 0.9233 | 0.9444 |
| Fold-4 | 0.8809 | 0.8980 | 0.8809 | 0.8980 |
| Fold-5 | 0.9363 | 0.9413 | 0.9363 | 0.9413 |
| Fold-6 | 0.8134 | 0.9149 | 0.8134 | 0.9149 |
| Fold-7 | 0.9023 | 0.9376 | 0.9023 | 0.9376 |
| Fold-8 | 0.9254 | 0.9453 | 0.9254 | 0.9457 |
| Fold-9 | 0.9224 | 0.9289 | 0.9224 | 0.9289 |
| Fold-10 | 0.9409 | 0.9544 | 0.9409 | 0.9544 |
| Mean | 0.9015 | 0.9274 | 0.9015 | 0.9273 |

Ultra(GAP9):

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **On GAP9 (GVSOC)** | | **On PC using PyTorch** | |
| **Acc before online training** | **Acc after online training** | **Acc before online training** | **Acc after online training** |
| Fold-0 | 0.9542 | 0.9875 | 0.9646 | 0.9771 |
| Fold-1 | 0.8979 | 0.9563 | 0.9083 | 0.9417 |
| Fold-2 | 0.8833 | 0.1125 | 0.9042 | 0.9396 |
| Fold-3 | 0.8438 | 0.1250 | 0.9042 | 0.9729 |
| Fold-4 | 0.8958 | 0.9438 | 0.8958 | 0.9333 |
| Fold-5 | 0.9583 | 0.9708 | 0.9583 | 0.9604 |
| Fold-6 | 0.9833 | 0.9979 | 0.9750 | 0.9938 |
| Mean | 0.9167 | 0.7277 | 0.9301 | 0.9598 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **On GAP9 (GVSOC)** | | **On PC using PyTorch** | |
| **Acc before online training** | **Acc after online training** | **Acc before online training** | **Acc after online training** |
| Fold-0 | 0.9542 | 0.9875 | 0.9646 | 0.9771 |
| Fold-1 | 0.8979 | 0.9563 | 0.9083 | 0.9417 |
| Fold-2 | 0.9208 | 0.9500 | 0.9354 | 0.9521 |
| Fold-3 | 0.8583 | 0.9708 | 0.8854 | 0.9792 |
| Fold-4 | 0.8958 | 0.9438 | 0.8958 | 0.9333 |
| Fold-5 | 0.9583 | 0.9708 | 0.9583 | 0.9604 |
| Fold-6 | 0.9833 | 0.9979 | 0.9750 | 0.9938 |
| Mean | 0.9241 | 0.9682 | 0.9318 | 0.9625 |

Partvalid:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **On GAP9 (GVSOC)** | | **On PC using PyTorch** | |
| **Acc before online training** | **Acc after online training** | **Acc before online training** | **Acc after online training** |
| Fold-0 | 0.9500 | 0.9667 | 0.9458 | 0.9667 |
| Fold-1 | 0.9146 | 0.9563 | 0.9229 | 0.9688 |
| Fold-2 | 0.9188 | 0.9292 | 0.9188 | 0.9375 |
| Fold-3 | 0.8313 | 0.8854 | 0.8458 | 0.9646 |
| Fold-4 | 0.9208 | 0.9458 | 0.9146 | 0.9354 |
| Fold-5 | 0.9271 | 0.9771 | 0.9333 | 0.9688 |
| Fold-6 | 0.9917 | 1.000 | 0.9917 | 0.9979 |
| Mean | 0.9220 | 0.9515 | 0.9247 | 0.9628 |

(fastexp with underflow check)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **On GAP9 (GVSOC)** | | **On PC using PyTorch** | |
| **Acc before online training** | **Acc after online training** | **Acc before online training** | **Acc after online training** |
| Fold-0 | 0.9542 | 0.9875 | 0.9646 | 0.9771 |
| Fold-1 | 0.8979 | 0.9563 | 0.9083 | 0.9417 |
| Fold-2 | 0.9042 | 0.9521 | 0.9042 | 0.9396 |
| Fold-3 | 0.8729 | 0.9604 | 0.9042 | 0.9729 |
| Fold-4 | 0.8958 | 0.9438 | 0.8958 | 0.9333 |
| Fold-5 | 0.9583 | 0.9708 | 0.9583 | 0.9604 |
| Fold-6 | 0.9833 | 0.9979 | 0.9750 | 0.9938 |
| Mean | 0.9238 | 0.9670 | 0.9301 | 0.9598 |

QVAR （fasterexp）：

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **On GAP9 (GVSOC)** | | **On PC using PyTorch** | |
| **Acc before online training** | **Acc after online training** | **Acc before online training** | **Acc after online training** |
| Fold-1 | 0.7527 | 0.9624 | 0.7419 | 0.9731 |
| Fold-2 | 0.8629 | 0.9371 | 0.8686 | 0.9371 |
| Fold-3 | 0.6124 | 0.8708 | 0.5955 | 0.8708 |
| Fold-4 | 0.3355 | 0.6839 | 0.3290 | 0.6774 |
| Fold-5 | 0.4540 | 0.7759 | 0.5000 | 0.8103 |
| Fold-6 | 0.5722 | 0.7944 | 0.5667 | 0.8167 |
| Fold-7 | 0.6264 | 0.8506 | 0.6552 | 0.8046 |
| Fold-8 | 0.8611 | 0.9667 | 0.8889 | 0.9722 |
| Fold-9 | 0.8606 | 0.9394 | 0.8667 | 0.9394 |
| Fold-10 | 0.4970 | 0.9172 | 0.5266 | 0.8757 |
| Fold-11 | 0.8708 | 0.9270 | 0.8876 | 0.9326 |
| Fold-12 | 0.8722 | 0.9333 | 0.8556 | 0.9222 |
| Fold-13 | 0.8409 | 0.8864 | 0.8352 | 0.8920 |
| Fold-14 | 0.8571 | 0.8686 | 0.8571 | 0.8743 |
| Fold-15 | 0.9045 | 0.9551 | 0.8820 | 0.9551 |
| Fold-16 | 0.5650 | 0.8305 | 0.5706 | 0.8249 |
| Fold-17 | 0.3864 | 0.6288 | 0.3712 | 0.6515 |
| Fold-18 | 0.4775 | 0.7921 | 0.4944 | 0.8090 |
| Fold-19 | 0.5747 | 0.7414 | 0.6149 | 0.7414 |
| Fold-20 | 0.7330 | 0.8920 | 0.7614 | 0.8864 |
| Mean | 0.6758 | 0.8577 | 0.6835 | 0.8583 |

QVAR （fastexp with underflow check）：

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **On GAP9 (GVSOC)** | | **On PC using PyTorch** | |
| **Acc before online training** | **Acc after online training** | **Acc before online training** | **Acc after online training** |
| Fold-1 | 0.7527 | 0.9785 | 0.7419 | 0.9731 |
| Fold-2 | 0.8571 | 0.9486 | 0.8686 | 0.9371 |
| Fold-3 | 0.6067 | 0.8483 | 0.5955 | 0.8708 |
| Fold-4 | 0.3355 | 0.7613 | 0.3290 | 0.6774 |
| Fold-5 | 0.4540 | 0.8621 | 0.5000 | 0.8103 |
| Fold-6 | 0.5611 | 0.9111 | 0.5667 | 0.8167 |
| Fold-7 | 0.6322 | 0.7989 | 0.6552 | 0.8046 |
| Fold-8 | 0.8611 | 0.9778 | 0.8889 | 0.9722 |
| Fold-9 | 0.8667 | 0.9636 | 0.8667 | 0.9394 |
| Fold-10 | 0.4911 | 0.9467 | 0.5266 | 0.8757 |
| Fold-11 | 0.8708 | 0.9157 | 0.8876 | 0.9326 |
| Fold-12 | 0.8722 | 0.9000 | 0.8556 | 0.9222 |
| Fold-13 | 0.8352 | 0.9148 | 0.8352 | 0.8920 |
| Fold-14 | 0.8514 | 0.8971 | 0.8571 | 0.8743 |
| Fold-15 | 0.8989 | 0.9382 | 0.8820 | 0.9551 |
| Fold-16 | 0.5706 | 0.8362 | 0.5706 | 0.8249 |
| Fold-17 | 0.3939 | 0.7273 | 0.3712 | 0.6515 |
| Fold-18 | 0.4607 | 0.8371 | 0.4944 | 0.8090 |
| Fold-19 | 0.5747 | 0.7184 | 0.6149 | 0.7414 |
| Fold-20 | 0.7386 | 0.9091 | 0.7614 | 0.8864 |
| Mean | 0.6743 | 0.8795 | 0.6835 | 0.8583 |

Gym(fasterexp)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **On GAP9 (GVSOC)** | | **On PC using PyTorch** | |
| **Acc before online training** | **Acc after online training** | **Acc before online training** | **Acc after online training** |
| Fold-1 | 0.5959 | 0.7995 | 0.9004 | 0.9278 |
| Fold-2 |  |  | 0.8701 | 0.8799 |
| Fold-3 |  |  | 0.9233 | 0.9444 |
| Fold-4 | 0. |  | 0.8809 | 0.8980 |
| Fold-5 | 0. | 0. | 0.9363 | 0.9413 |
| Fold-6 | 0. | 0. | 0.8134 | 0.9149 |
| Fold-7 | 0. | 0. | 0.9023 | 0.9376 |
| Fold-8 | 0. | 0. | 0.9254 | 0.9457 |
| Fold-9 | 0. | 0. | 0.9224 | 0.9289 |
| Fold-10 | 0. | 0. | 0.9409 | 0.9544 |
| Mean | 0. | 0. | 0.9015 | 0.9273 |

Gym(fastexp with underflow check)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **On GAP9 (GVSOC)** | | **On PC using PyTorch** | |
| **Acc before online training** | **Acc after online training** | **Acc before online training** | **Acc after online training** |
| Fold-1 | 0.6477 | 0.6907 | 0.9004 | 0.9278 |
| Fold-2 |  |  | 0.8701 | 0.8799 |
| Fold-3 |  |  | 0.9233 | 0.9444 |
| Fold-4 | 0. |  | 0.8809 | 0.8980 |
| Fold-5 | 0. | 0. | 0.9363 | 0.9413 |
| Fold-6 | 0. | 0. | 0.8134 | 0.9149 |
| Fold-7 | 0. | 0. | 0.9023 | 0.9376 |
| Fold-8 | 0. | 0. | 0.9254 | 0.9457 |
| Fold-9 | 0. | 0. | 0.9224 | 0.9289 |
| Fold-10 | 0. | 0. | 0.9409 | 0.9544 |
| Mean | 0. | 0. | 0.9015 | 0.9273 |