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## Supplementary Material

Table 3: Balanced accuracy (%) across different sampling rates for the THCA, SALK, and BUCA datasets. Values are reported as mean ± standard deviation across five random sampling seeds.

| Encoder | 1% | 5% | 10% | 20% | 50% | 100% |
|---|---|---|---|---|---|---|
| **THCA** | | | | | | |
| **DS-FM** (Domain-Specific Foundation Model) | | | | | | |
| Conch-v1 | 57.8 ± 2.4 | 87.3 ± 0.7 | 90.6 ± 1.0 | 90.3 ± 1.3 | 91.0 ± 0.7 | 91.6 ± 0.0 |
| Conch-v15 | 80.0 ± 2.2 | 88.2 ± 1.3 | 88.8 ± 1.8 | 89.8 ± 1.4 | 90.4 ± 0.6 | 91.0 ± 0.0 |
| CTransPath | 79.8 ± 1.2 | 89.3 ± 1.2 | 90.6 ± 1.5 | 92.5 ± 2.0 | 93.4 ± 1.5 | 94.0 ± 0.0 |
| GigaPath | 53.5 ± 1.4 | 82.6 ± 1.2 | 84.8 ± 3.1 | 86.4 ± 1.7 | 86.6 ± 1.2 | 87.9 ± 0.0 |
| Hibou-L | 55.6 ± 2.3 | 82.2 ± 1.5 | 86.1 ± 1.6 | 84.7 ± 1.4 | 85.6 ± 1.1 | 84.8 ± 0.0 |
| H-Optimus-v1 | 53.5 ± 2.4 | 81.4 ± 2.1 | 85.3 ± 2.3 | 86.1 ± 0.9 | 86.6 ± 0.8 | 86.9 ± 0.0 |
| Kaiko-L | 61.8 ± 3.2 | 89.0 ± 1.0 | 90.4 ± 1.8 | 91.1 ± 1.8 | 91.8 ± 0.6 | 91.2 ± 0.0 |
| Lunit-S | 70.8 ± 1.7 | 80.8 ± 0.7 | 83.4 ± 2.0 | 85.4 ± 2.4 | 86.7 ± 1.0 | 87.6 ± 0.0 |
| Phikon-v1 | 73.2 ± 2.3 | 81.5 ± 1.2 | 83.7 ± 2.0 | 83.8 ± 2.3 | 85.3 ± 1.4 | 86.1 ± 0.0 |
| Phikon-v2 | 52.4 ± 3.9 | 80.9 ± 2.3 | 84.3 ± 1.8 | 86.6 ± 1.3 | 88.2 ± 0.9 | 88.5 ± 0.0 |
| Uni-v1 | 56.4 ± 3.3 | 85.1 ± 1.9 | 87.5 ± 2.7 | 87.9 ± 1.0 | 87.9 ± 0.8 | 87.8 ± 0.0 |
| Uni-v2 | 56.7 ± 2.6 | 85.0 ± 2.0 | 88.1 ± 1.1 | 89.1 ± 1.7 | 90.3 ± 0.6 | 91.3 ± 0.0 |
| Virchow-v1 | 58.7 ± 2.4 | 86.0 ± 1.8 | 89.5 ± 2.4 | 87.6 ± 1.4 | 89.2 ± 1.6 | 91.1 ± 0.0 |
| Virchow-v2 | 61.9 ± 3.0 | 86.2 ± 1.6 | 89.8 ± 1.0 | 90.4 ± 0.7 | 91.6 ± 0.0 | 91.6 ± 0.0 |
| **GP-FM** (General-Purpose Foundation Model) | | | | | | |
| Dino-v2 | 43.0 ± 3.3 | 75.3 ± 4.0 | 81.0 ± 4.5 | 83.4 ± 2.5 | 87.4 ± 0.9 | 86.7 ± 0.0 |
| **GP-SL** (General-Purpose Supervised Learning) | | | | | | |
| ResNet-152 | 49.9 ± 1.4 | 79.6 ± 1.3 | 81.9 ± 3.2 | 83.9 ± 3.0 | 84.5 ± 2.0 | 85.1 ± 0.0 |
| ResNet-50 | 51.9 ± 2.8 | 82.8 ± 3.1 | 86.8 ± 3.0 | 87.7 ± 1.9 | 88.6 ± 2.2 | 90.1 ± 0.0 |
| ViT-H | 72.7 ± 4.4 | 77.5 ± 3.7 | 83.6 ± 3.2 | 83.6 ± 1.9 | 84.8 ± 0.3 | 84.4 ± 0.0 |
| **SALK** | | | | | | |
| **DS-FM** (Domain-Specific Foundation Model) | | | | | | |
| Conch-v1 | 76.7 ± 3.0 | 85.1 ± 2.0 | 89.8 ± 1.1 | 92.5 ± 1.2 | 91.7 ± 1.2 | 93.3 ± 0.0 |
| Conch-v15 | 68.6 ± 3.2 | 87.6 ± 1.3 | 94.1 ± 1.2 | 95.9 ± 0.7 | 96.6 ± 0.3 | 96.6 ± 0.0 |
| CTransPath | 65.4 ± 2.9 | 78.6 ± 2.3 | 84.4 ± 1.7 | 83.8 ± 1.9 | 84.1 ± 1.2 | 84.5 ± 0.0 |
| GigaPath | 75.2 ± 3.7 | 84.7 ± 3.0 | 89.9 ± 1.1 | 91.2 ± 2.5 | 92.4 ± 1.3 | 91.4 ± 0.0 |
| Hibou-L | 77.6 ± 3.8 | 90.4 ± 1.1 | 94.7 ± 1.1 | 96.2 ± 1.2 | 96.5 ± 0.4 | 97.8 ± 0.0 |
| H-Optimus-v1 | 73.3 ± 1.9 | 82.4 ± 2.0 | 86.7 ± 2.0 | 88.8 ± 1.3 | 89.6 ± 0.6 | 91.4 ± 0.0 |
| Kaiko-L | 78.1 ± 2.8 | 85.2 ± 2.6 | 91.7 ± 0.7 | 93.2 ± 0.8 | 95.0 ± 0.7 | 94.4 ± 0.0 |
| Lunit-S | 62.0 ± 2.9 | 81.8 ± 2.3 | 87.4 ± 2.6 | 90.5 ± 2.1 | 90.8 ± 1.4 | 91.1 ± 0.0 |
| Phikon-v1 | 62.5 ± 2.7 | 81.4 ± 2.9 | 84.7 ± 3.1 | 87.4 ± 1.3 | 88.5 ± 0.4 | 90.4 ± 0.0 |
| Phikon-v2 | 73.8 ± 3.8 | 81.7 ± 2.5 | 85.7 ± 1.4 | 87.5 ± 1.4 | 86.5 ± 0.9 | 85.7 ± 0.0 |

*Continued on next page*

| Encoder | 1% | 5% | 10% | 20% | 50% | 100% |
|---|---|---|---|---|---|---|
| Uni-v1 | 76.8 ± 2.9 | 82.4 ± 2.7 | 89.9 ± 3.3 | 91.6 ± 1.6 | 93.4 ± 0.8 | 94.4 ± 0.0 |
| Uni-v2 | 77.0 ± 3.6 | 86.9 ± 2.5 | 92.7 ± 0.9 | 93.8 ± 1.0 | 95.3 ± 0.6 | 96.8 ± 0.0 |
| Virchow-v1 | 71.6 ± 3.0 | 79.4 ± 2.2 | 83.3 ± 3.3 | 83.5 ± 1.4 | 85.4 ± 1.9 | 85.9 ± 0.0 |
| Virchow-v2 | 77.1 ± 2.6 | 88.3 ± 1.7 | 92.8 ± 1.6 | 94.1 ± 0.6 | 93.9 ± 0.6 | 93.9 ± 0.0 |
| **GP-FM** (General-Purpose Foundation Model) | | | | | | |
| Dino-v2 | 67.6 ± 2.0 | 66.1 ± 1.9 | 70.4 ± 2.3 | 69.5 ± 2.8 | 71.1 ± 1.4 | 72.2 ± 0.0 |
| **GP-SL** (General-Purpose Supervised Learning) | | | | | | |
| ResNet-152 | 70.8 ± 2.5 | 71.5 ± 4.0 | 78.5 ± 3.2 | 79.4 ± 3.3 | 80.9 ± 0.9 | 79.0 ± 0.0 |
| ResNet-50 | 70.1 ± 1.7 | 72.5 ± 3.3 | 78.8 ± 2.7 | 81.9 ± 2.1 | 83.7 ± 3.1 | 85.3 ± 0.0 |
| ViT-H | 60.4 ± 2.5 | 72.9 ± 5.0 | 78.4 ± 4.1 | 79.5 ± 2.8 | 82.7 ± 2.6 | 83.3 ± 0.0 |
| **BUCA** | | | | | | |
| **DS-FM** (Domain-Specific Foundation Model) | | | | | | |
| Conch-v1 | 50.0 ± 0.0 | 50.1 ± 3.0 | 59.8 ± 4.7 | 64.7 ± 5.2 | 65.7 ± 2.0 | 70.0 ± 0.0 |
| Conch-v15 | 50.0 ± 0.0 | 51.6 ± 3.8 | 67.7 ± 4.9 | 70.7 ± 1.2 | 72.6 ± 2.4 | 73.8 ± 0.0 |
| CTransPath | 41.3 ± 5.1 | 73.0 ± 3.9 | 77.3 ± 5.4 | 76.7 ± 5.0 | 72.4 ± 4.7 | 69.3 ± 0.0 |
| GigaPath | 55.7 ± 4.7 | 60.2 ± 7.5 | 59.5 ± 4.3 | 65.9 ± 4.3 | 65.8 ± 1.0 | 63.5 ± 0.0 |
| Hibou-L | 60.9 ± 3.0 | 71.6 ± 7.7 | 78.1 ± 6.5 | 77.2 ± 7.5 | 79.4 ± 5.4 | 76.3 ± 0.0 |
| H-Optimus-v1 | 61.2 ± 2.9 | 63.5 ± 3.1 | 70.0 ± 5.7 | 67.3 ± 3.4 | 62.9 ± 3.4 | 56.0 ± 0.0 |
| Kaiko-L | 60.7 ± 3.3 | 65.9 ± 7.2 | 70.5 ± 8.8 | 70.0 ± 7.5 | 68.4 ± 0.9 | 67.5 ± 0.0 |
| Lunit-S | 43.9 ± 4.3 | 67.1 ± 6.8 | 72.0 ± 6.8 | 75.1 ± 5.3 | 77.2 ± 0.5 | 77.5 ± 0.0 |
| Phikon-v1 | 44.8 ± 4.7 | 77.5 ± 6.4 | 82.6 ± 2.6 | 81.6 ± 2.2 | 82.4 ± 1.8 | 81.0 ± 0.0 |
| Phikon-v2 | 58.0 ± 3.0 | 70.2 ± 2.9 | 69.8 ± 2.1 | 69.0 ± 2.5 | 68.4 ± 2.8 | 69.8 ± 0.0 |
| Uni-v1 | 61.0 ± 2.8 | 73.1 ± 6.7 | 75.8 ± 5.0 | 74.5 ± 5.8 | 71.9 ± 1.5 | 71.2 ± 0.0 |
| Uni-v2 | 59.5 ± 2.1 | 68.2 ± 7.1 | 70.4 ± 7.3 | 72.0 ± 2.8 | 72.7 ± 3.1 | 78.0 ± 0.0 |
| Virchow-v1 | 59.2 ± 3.9 | 81.4 ± 7.4 | 87.7 ± 3.8 | 88.8 ± 1.5 | 89.4 ± 1.4 | 89.4 ± 0.0 |
| Virchow-v2 | 59.7 ± 3.4 | 68.9 ± 5.8 | 68.0 ± 5.6 | 68.2 ± 4.2 | 64.1 ± 0.0 | 64.1 ± 0.0 |
| **GP-FM** (General-Purpose Foundation Model) | | | | | | |
| Dino-v2 | 53.4 ± 3.3 | 48.6 ± 6.1 | 48.1 ± 2.7 | 48.4 ± 7.7 | 57.1 ± 4.4 | 56.3 ± 0.0 |
| **GP-SL** (General-Purpose Supervised Learning) | | | | | | |
| ResNet-152 | 57.9 ± 4.0 | 66.6 ± 2.3 | 66.9 ± 2.8 | 65.2 ± 1.7 | 64.7 ± 0.8 | 64.0 ± 0.0 |
| ResNet-50 | 61.3 ± 4.3 | 68.2 ± 8.1 | 71.5 ± 10.3 | 64.8 ± 4.8 | 65.3 ± 1.7 | 65.1 ± 0.0 |
| ViT-H | 40.0 ± 2.7 | 73.0 ± 5.1 | 72.3 ± 6.3 | 75.2 ± 4.1 | 76.9 ± 2.4 | 80.5 ± 0.0 |