Using optimized AI software can significantly improve AI workload performance, developer productivity, and compute resource usage costs. Intel® oneAPI libraries enable the AI ecosystem with optimized software, libraries, and frameworks. Software optimizations include leveraging accelerators, parallelizing operations, and maximizing core usage.

We encourage you to check out Intel’s full suite of AI tools and framework optimizations. For more optimization packages and tuning guides, visit the Intel® Optimization Hub.

**TensorFlow**

Intel optimizations delivering up to 3x faster deep learning¹ are upstreamed into the main branch:

```
pip install tensorflow
```

For versions 2.5-2.8: enable with the environment variable:

```
export TF_ENABLE_ONEDNN_OPTS=1
```

For versions 2.9+: ON by default.

**XGBoost**

Optimizations for training and prediction on CPU are upstreamed.

Download the latest XGBoost – newer versions have the most optimizations.

Optimized methods include: split, partitioning, and hist tree method.

```
'tree_method': hist,' #try hist tree
```

**PyTorch**

Intel upstreams optimizations to PyTorch. These features often debut in Intel® Extension for PyTorch, which can speed performance up to 2.7x.²

Install open source PyTorch (Guide). Then install Intel Extension for PyTorch, choosing from:

```
pip install intel-extension-for-pytorch
conda install -c intel intel-extension-for-pytorch
docker pull intel/intel-optimized-pytorch
```

For previous versions of PyTorch, be sure to install the corresponding version of the extension. Details in the Installation Guide.

<table>
<thead>
<tr>
<th>PyTorch Version</th>
<th>v1.13</th>
<th>v1.12</th>
<th>v1.11</th>
<th>v1.10</th>
<th>v1.9</th>
<th>v1.8</th>
<th>v1.7</th>
<th>v1.5-rc3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extension Version</td>
<td>v1.13</td>
<td>v1.12</td>
<td>v1.11</td>
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<td>v1.9</td>
<td>v1.8</td>
<td>v1.7</td>
<td>v1.5</td>
</tr>
</tbody>
</table>

To enable these extensions, add these two lines to your Python code:

```
import intel_extension_for_pytorch as ipex
model = ipex.optimize(your_model)
```
**Pandas**

**Install** Modin*, choosing from:

- `pip install modin[ray]`
- `conda install -c conda-forge modin-ray`

Replace `import` in your Python code:

```python
import modin.pandas as pd
```

**Activate the patch in your Python code:**

```python
from sklearnex import patch_sklearn
patch_sklearn()
```

**Or run it without changing code:**

```bash
python -m sklearnex my_application.py
```

Works with Pandas v1.3.4+

Scale your Pandas workflows by changing **one line of code**.

Intel® Distribution of Modin* uses all your cores to speed DataFrame processing up to 10-100x.

All it takes is two lines of code!

---

**Intel® Distribution for Python**

- `conda install -c intelpython3_full python=3.x`

Works with Intel® Extension for Scikit-learn*, you can accelerate up to 10-100x while conforming to scikit-learn APIs. All it takes is two lines of code!

---

**PaddlePaddle**

Intel’s optimizations are **upstreamed** into the main branch, delivering automatic acceleration on Intel processors.

Try distributed training on CPU!

---

**SciPy**

Intel® oneAPI Math Kernel Library (oneMKL) optimizations accelerate scientific compute.

Install (Currently only available via conda):

- `conda install scikit-learn-intelex`
- `conda install scikit-learn-intelex`

Works with scipy v1.3.3+

With Intel® Extension for Scikit-learn*, you can accelerate up to 10-100x while conforming to scikit-learn APIs. All it takes is two lines of code!

---

**NumPy**

Intel’s optimizations use oneMKL to accelerate numerical compute.

Install (Currently only available via conda):

- `conda install numpy`

Works with NumPy v1.17.5+
For best practices, check out open-source AI reference kits, which are end-to-end AI solution examples, optimized for Intel hardware. Learn more about Intel’s full suite of AI development tools and resources. For performance analysis and profiling, see Intel® VTune™ Profiler.

Apache Spark*
The Optimized Analytics Package (OAP) for Spark® Platform can optimize Spark, with open-source packages for RayDP integration, execution engine, and MLlib.
Install using conda for Spark v3.x:

```
conda create -n oapenv -c conda-forge -c intel -y oap=1.5.0.spark32
```
Then add configuration settings listed in the installation guide to this file:

```
$SPARK_HOME/conf/spark-defaults.conf
```

Apache Spark MLlib  v3.x
OAP MLlib accelerates machine learning algorithms in Spark MLlib up to 3x. It’s compatible with Spark MLlib and open-source.

Apache Spark SQL  v3.x
Gazelle Plugin is a native engine for Spark SQL. It utilizes Apache Arrow, SIMD kernels, and LLVM expression for up to 2.5x faster performance.

Apache Kafka* v3.x
Get the most out of your Kafka performance.

More optimizations: CatBoost, Apache MXNet*, ONNX RT*, Numba*, LightGBM

Intel® Neural Compressor
An open-source library to compress and optimize your AI models, with an average speedup of 2.2x. Available techniques include auto-quantization, pruning for sparsity, and knowledge distillation.

Use the web application, or install for command-line use:

```
pip install neural-compressor
```

For best practices, check out open-source AI reference kits, which are end-to-end AI solution examples, optimized for Intel hardware. Learn more about Intel’s full suite of AI development tools and resources. For performance analysis and profiling, see Intel® VTune™ Profiler.

Support Forums:
AI Frameworks | SDKs and Libraries
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Performance Claims