ONNX in EDDL

Lab 0: ECVL + EDDL environment

Winter School 24/01/2022

The project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 825111.

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What is ONNX?

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What is ONNX?

Open Neural Network Exchange

- Open format to represent ML models
- Defined by a set of **Operators** to build computational graphs
- Uses **Protocol Buffers** as the mechanism to serialize the models

Key benefits

- Frameworks **interoperability**
- Inference hardware **optimizations**

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Operators support

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Operators support

EDDL coverage of the ONNX operators

We **don't support** the full ONNX operators set

All the main layers of the EDDL are supported. The **exceptions** are:

- **Data transformations:** Most of them are not in ONNX standard (Coverage list)
  - The ones supported are **Pad** and **Scale**
- **Data augmentation layers:** Not in ONNX standard (Coverage list)
- **Noise layers:** Not in ONNX standard (Coverage list)

Complete layers coverage list in eddl_progress.md

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EDDL ONNX API

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EDDL ONNX API

Functionalities of the ONNX module in EDDL

- Export/import your EDDL models
- Import pretrained models from our model Zoo
- Import models from other libraries*

*Remember that not all the operators are supported. Errors may appear

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EDDL ONNX API

Export example

```
# Create your model
model = ...

# The model must be built to export it
eddl.build(model, ...)

eddl.save_net_to_onnx_file(model, 'my_model.onnx')
```

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EDDL ONNX API

Import example

```python
model = eddl.import_net_from_onnx_file('my_model.onnx')
# or you can change the input layer of the model to fit your data
model = eddl.import_net_from_onnx_file('my_model.onnx', input_shape=(3, 512, 512))


eddl.build(model,
           o=eddl.adam(0.001),                  # Optimizer
           lo=['categorical_cross_entropy'],    # Losses
           me=['accuracy'],                     # Metrics
           cs=eddl.CS_GPU(),                    # Computing Service
           init_weights=False)                  # Avoid reinitializing the weights
```

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Model Zoo

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Model Zoo

Models included

One of the main advantages of ONNX in the EDDL is to import pretrained models for **transfer learning**

We currently support some popular topologies for image classification (pretrained with ImageNet):

- **VGG:** The 16 and 19 variants, with and without BatchNormalization
- **ResNet:** 18, 34, 50, 101 and 152 variants
- **DenseNet-121**

You can check them in the documentation here

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Model Zoo

Full model import example

```python
# Import the complete model (with the classifier)
feature_extractor = eddl.download_resnet18(top=False)
# or, you can also change the input shape of the imported model
feature_extractor = eddl.download_resnet18(top=False, input_shape=(3, 512, 512))

eddl.build(model,
           o=eddl.adam(0.001),                  # Optimizer
           lo=['categorical_cross_entropy'],    # Losses
           me=['accuracy'],                     # Metrics
           cs=eddl.CS_GPU(),                    # Computing Service
           init_weights=False)                  # Avoid reinitializing the weights
```

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Model Zoo

Feature extractor import example

```python
# Import the model without the classifier
feature_extractor = eddl.download_resnet18()
# or, you can also change the input shape of the imported model
feature_extractor = eddl.download_resnet18(input_shape=(3, 512, 512))

# Get the last layer with the extracted features
top_layer = eddl.getLayer(feature_extractor, 'top')

# Add the classifier
dense0 = eddl.ReLu(eddl.Dense(top_layer, 512, name='dense0'))
out_ = eddl.Softmax(eddl.Dense(dense0, 10, name='dense1'))  # 10 output classes

# Get the input layer to build the new model
in_ = eddl.getLayer(feature_extractor, 'input')

# Create the final model
model = eddl.Model([in_], [out_])

eddl.build(model,
           o=eddl.adam(0.001),                  # Optimizer
           lo=['categorical_cross_entropy'],    # Losses
           me=['accuracy'],                     # Metrics
           cs=eddl.CS_GPU(),                    # Computing Service
           init_weights=False)                  # Avoid reinitializing the weights

# Initialize the new layers that are not pretrained
for l_name in ['dense0', 'dense1']:
    eddl.initializeLayer(model, l_name)
```

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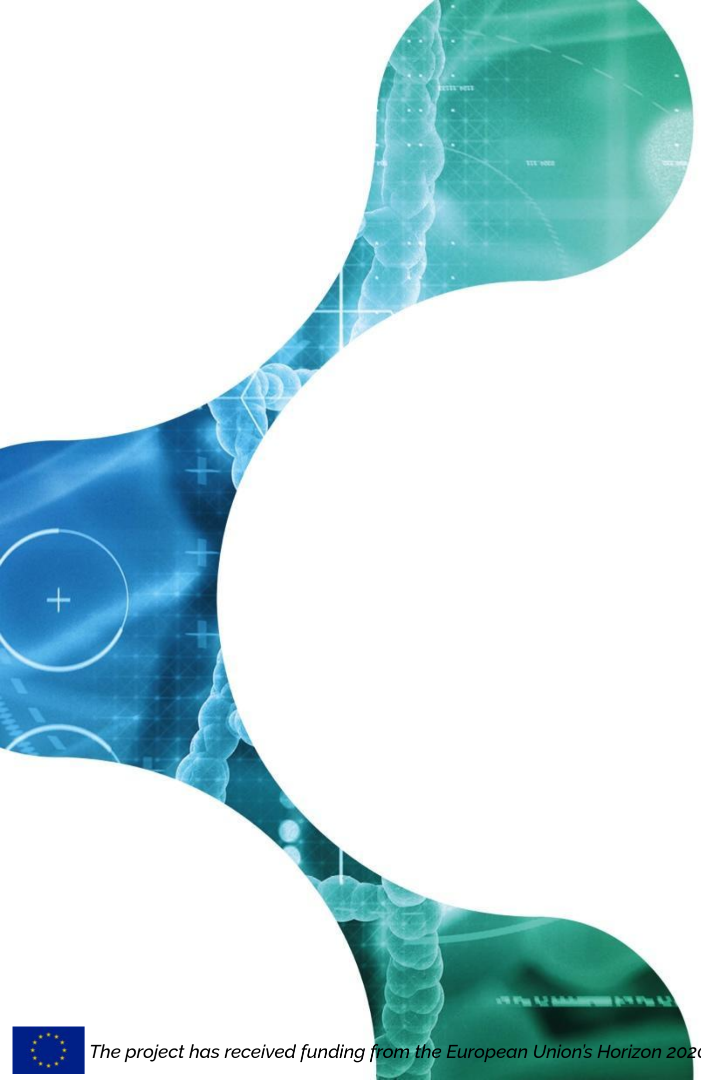

Resources

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Resources

Additional links with useful information

EDDL ONNX documentation

https://deephealthproject.github.io/eddl/model/onnx.html#

Netron

ONNX models visualizer (web app here)

ONNX Simplifier

Tool to avoid some importing errors (github here)

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DEEPHEALTH

Thank you!

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