
pystencils*autodiff Documentation*

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Dec 17, 2019

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This is the documentation of **pystencils-autodiff**.

This document assumes that you are already familiar with [pystencils](#). If not, here is a good [tutorial to start](#).

Installation of this Auto-Diff Extension

Install via pip :

```
pip install pystencils-autodiff
```

or if you downloaded this [repository](#) using:

```
pip install -e .
```

Then, you can access the submodule *pystencils.autodiff*.

```
import pystencils.autodiff
```


CHAPTER 2

Usage

Create a `pystencils.AssignmentCollection` with `pystencils`:

```
import sympy
import pystencils

z, y, x = pystencils.fields("z, y, x: [20,30]")

forward_assignments = pystencils.AssignmentCollection({
    z[0, 0]: x[0, 0] * sympy.log(x[0, 0] * y[0, 0])
})

print(forward_assignments)
```

```
Subexpressions:
Main Assignments:
    z[0,0] ← x_C*log(x_C*y_C)
```

You can then obtain the corresponding backward assignments:

```
from pystencils.autodiff import AutoDiffOp, create_backward_assignments
backward_assignments = create_backward_assignments(forward_assignments)

# Sorting for reproducible outputs
backward_assignments.main_assignments = sorted(backward_assignments.main_assignments,
↪key=lambda a: str(a))

print(backward_assignments)
```

You can see the derivatives with respect to the two inputs multiplied by the gradient diff_{z_C} of the output z_C .

```
Subexpressions:
Main Assignments:
```

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```
\hat{x}[0,0] ← diffz_C*(log(x_C*y_C) + 1)
\hat{y}[0,0] ← diffz_C*x_C/y_C
```

You can also use the class `pystencils_autodiff.AutoDiffOp` to obtain both the assignments (if you are curious) and auto-differentiable operations for Tensorflow...

```
op = AutoDiffOp(forward_assignments)
backward_assignments = op.backward_assignments

tensorflow_op = op.create_tensorflow_op(backend='tensorflow_native', use_cuda=False)
```

... or Torch:

```
torch_op = op.create_tensorflow_op(backend='torch_native', use_cuda=False)
```

2.1 Contents

2.1.1 License

`pystencils_autodiff` – Adds automatic differentiation and generation of Tensorflow/PyTorch operations to `pystencils`

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2.1.2 Contributors

- Stephan Seitz <stephan.seitz@fau.de>

2.1.3 Changelog

2.1.3.1 0.2.2

- Add possibility to overwrite `nvcc` arch for Tensorflow compilation: `PYSTENCILS_TENSORFLOW_NVCC_ARCH`
- Add possibility to compile Tensorflow module without loading

2.1.3.2 0.2.1

- Bugfix: `tensorflow_jit` had erroneous code for writing to `pystencils`' config file

2.1.3.3 0.2.0

- Compilation of Torch/Tensorflow/pybind11 modules with an AST (instead of pure jinja as before)

2.1.4 pystencils_autodiff

2.1.4.1 pystencils_autodiff package

2.1.4.1.1 Subpackages

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2.1.4.1.6 pystencils_autodiff.transformations module

2.1.4.1.7 Module contents

2.2 Indices and tables

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