tf.contrib.distributions.bijectors.SinhArcsinh

Contents

Class `SinhArcsinh`

Inherits From: `Bijector`

Defined in `tensorflow/contrib/distributions/python/ops/bijectors/sinh_arcsinh_impl.py`.

Compute `Y = g(X) = Sinh( (Arcsinh(X) + skewness) * tailweight )`.

For `skewness in (-inf, inf)` and `tailweight in (0, inf)`, this transformation is a diffeomorphism of the real line `(-inf, inf)`. The inverse transform is `X = g^{-1}(Y) = Sinh( ArcSinh(Y) / tailweight - skewness )`.

The `SinhArcsinh` transformation of the Normal is described in Sinh-arcsinh distributions This Bijector allows a similar transformation of any distribution supported on `(-inf, inf)`.

Meaning of the parameters

- If `skewness = 0` and `tailweight = 1`, this transform is the identity.
- Positive (negative) `skewness` leads to positive (negative) skew.
- positive skew means, for unimodal `X` centered at zero, the mode of `Y` is "tilted" to the right.
- positive skew means positive values of `Y` become more likely, and negative values become less likely.
- Larger (smaller) `tailweight` leads to fatter (thinner) tails.
- Fatter tails mean larger values of `|Y|` become more likely.
- If `X` is a unit Normal, `tailweight < 1` leads to a distribution that is "flat" around `Y = 0`, and a very steep drop-off in the tails.
- If `X` is a unit Normal, `tailweight > 1` leads to a distribution more peaked at the mode with heavier tails.

To see the argument about the tails, note that for `|X| >> 1` and `|X| >> (|skewness| * tailweight)**tailweight`, we have `Y approx 0.5 X**tailweight e**(sign(X) skewness * tailweight)`.

Properties

`dtype`

dtype of `Tensor`s transformable by this distribution.

`event_ndims`

Returns then number of event dimensions this bijector operates on.

`graph_parents`

Returns this `Bijector`'s graph_parents as a Python list.

`is_constant_jacobian`

Returns true iff the Jacobian is not a function of x.

> ★ **Note:** Jacobian is either constant for both forward and inverse or neither.

Returns:

- `is_constant_jacobian`: Python `bool`.

`name`

Returns the string name of this `Bijector`.

`skewness`

The `skewness` in: `Y = Sinh((Arcsinh(X) + skewness) * tailweight)`.

`tailweight`

The `tailweight` in: `Y = Sinh((Arcsinh(X) + skewness) * tailweight)`.

`validate_args`

Returns True if Tensor arguments will be validated.

Methods

`__init__`

```
__init__(
    skewness=0.0,
    tailweight=1.0,
    event_ndims=0,
    validate_args=False,
    name='sinh_arcsinh'
)
```

Instantiates the `SinhArcsinh` bijector.

Args:

- `skewness`: Skewness parameter. Float-type `Tensor`.

- `tailweight`: Tailweight parameter. Positive `Tensor` of same `dtype` as `skewness` and broadcastable `shape`.
- `event_ndims`: Python scalar indicating the number of dimensions associated with a particular draw from the distribution.
- `validate_args`: Python `bool` indicating whether arguments should be checked for correctness.
- `name`: Python `str` name given to ops managed by this object.

forward

```
forward(
    x,
    name='forward'
)
```

Returns the forward `Bijector` evaluation, i.e., X = g(Y).

Args:

- `x`: `Tensor`. The input to the "forward" evaluation.
- `name`: The name to give this op.

Returns:

`Tensor`.

Raises:

- `TypeError`: if `self.dtype` is specified and `x.dtype` is not `self.dtype`.
- `NotImplementedError`: if `_forward` is not implemented.

forward_event_shape

```
forward_event_shape(input_shape)
```

Shape of a single sample from a single batch as a `TensorShape`.

Same meaning as `forward_event_shape_tensor`. May be only partially defined.

Args:

- `input_shape`: `TensorShape` indicating event-portion shape passed into `forward` function.

Returns:

- `forward_event_shape_tensor`: `TensorShape` indicating event-portion shape after applying `forward`. Possibly unknown.

forward_event_shape_tensor

```
forward_event_shape_tensor(
    input_shape,
    name='forward_event_shape_tensor'
)
```

Shape of a single sample from a single batch as an `int32` 1D `Tensor`.

Args:

- `input_shape`: `Tensor`, `int32` vector indicating event-portion shape passed into `forward` function.
- `name`: name to give to the op

Returns:

- `forward_event_shape_tensor`: `Tensor`, `int32` vector indicating event-portion shape after applying `forward`.

forward_log_det_jacobian

```
forward_log_det_jacobian(
    x,
    name='forward_log_det_jacobian'
)
```

Returns both the forward_log_det_jacobian.

Args:

- `x`: `Tensor`. The input to the "forward" Jacobian evaluation.
- `name`: The name to give this op.

Returns:

`Tensor`, if this bijector is injective. If not injective this is not implemented.

Raises:

- `TypeError`: if `self.dtype` is specified and `y.dtype` is not `self.dtype`.
- `NotImplementedError`: if neither `_forward_log_det_jacobian` nor {`_inverse`, `_inverse_log_det_jacobian`} are implemented, or this is a non-injective bijector.

inverse

```
inverse(
    y,
    name='inverse'
)
```

Returns the inverse `Bijector` evaluation, i.e., X = g^{-1}(Y).

Args:

- `y`: `Tensor`. The input to the "inverse" evaluation.
- `name`: The name to give this op.

Returns:

`Tensor`, if this bijector is injective. If not injective, returns the k-tuple containing the unique `k` points `(x1, ..., xk)` such that `g(xi) = y`.

Raises:

- `TypeError`: if `self.dtype` is specified and `y.dtype` is not `self.dtype`.
- `NotImplementedError`: if `_inverse` is not implemented.

inverse_event_shape

```
inverse_event_shape(output_shape)
```

Shape of a single sample from a single batch as a `TensorShape`.

Same meaning as `inverse_event_shape_tensor`. May be only partially defined.

Args:

- `output_shape`: `TensorShape` indicating event-portion shape passed into `inverse` function.

Returns:

- `inverse_event_shape_tensor`: `TensorShape` indicating event-portion shape after applying `inverse`. Possibly unknown.

inverse_event_shape_tensor

```
inverse_event_shape_tensor(
    output_shape,
    name='inverse_event_shape_tensor'
)
```

Shape of a single sample from a single batch as an `int32` 1D `Tensor`.

Args:

- `output_shape`: `Tensor`, `int32` vector indicating event-portion shape passed into `inverse` function.
- `name`: name to give to the op

Returns:

- `inverse_event_shape_tensor`: `Tensor`, `int32` vector indicating event-portion shape after applying `inverse`.

inverse_log_det_jacobian

```
inverse_log_det_jacobian(
    y,
    name='inverse_log_det_jacobian'
)
```

Returns the (log o det o Jacobian o inverse)(y).

Mathematically, returns: `log(det(dX/dY))(Y)`. (Recall that: `X=g^{-1}(Y)`.)

Note that `forward_log_det_jacobian` is the negative of this function, evaluated at `g^{-1}(y)`.

Args:

- `y`: `Tensor`. The input to the "inverse" Jacobian evaluation.
- `name`: The name to give this op.

Returns:

`Tensor`, if this bijector is injective. If not injective, returns the tuple of local log det Jacobians, `log(det(Dg_i^{-1}(y)))`, where `g_i` is the restriction of `g` to the `ith` partition `Di`.

Raises:

- `TypeError`: if `self.dtype` is specified and `y.dtype` is not `self.dtype`.
- `NotImplementedError`: if `_inverse_log_det_jacobian` is not implemented.
