project_b4/reconstruction/preprocessing/feature_generation.py 2021-06-25T15:49+02:00

```python
import numpy as np
import matplotlib.pyplot as plt

class FeatureGenerator():
    """This class generates features for an event

    Based on the values measured in the detector, arbitrary features
    can be generated. These can be used for machine learning exercises
    such as classifying the particle type or estimating energy and origin.
    """

    def __init__(self, detector):
        """Sets up the feature generator

        Parameters
        ----------
        detector : Detector object
            A detector object for which the feature generator will be set up.
        """
        self.detector = detector

    def analyse(self, event):
        """Reconstruct an event measured in the assigned detector.

        Parameters
        ----------
        event : Event
            The event which we want to reconstruct.

        Returns
        -------
        Features: Dict
            A dictionary of arbitrary features.
            Values are to scalar to be fed into a random forest
        """
        # ---------
        # Exercise 18 (Sheet 9):
        # ---------
        # Feature Generation (exercises/feature_generation.py)

        mean = np.mean(event.pixels)
        max = np.max(event.pixels)

        features = {
            'max_pixel_value': max,
            'variance_pixel_value': np.var(event.pixels),
            'mean_pixel_value': mean,
            '(max/mean)_pixel_value': max/mean,
            'pixels_above_half_max': (event.pixels > 0.5*max).sum(),
            'pixels_above_mean': (event.pixels > mean).sum()
        }


        return features
```