
GenTex

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INTRODUCTION

GenTex stands for General Texture analysis.

This package provides a suite of routines that combines standard texture analysis methods based on GLCM and entropy/statistical complexity analysis methods.

WHAT IS THIS PACKAGE FOR?

GenTex provides a number of the standard algorithms required for generating complexity/texture measure estimates from multimodal imaging data. These include:

1. Generation of multidimensional feature spaces from multimodal ‘image’ data (i.e. multiple ‘co-registered’ 1,2,3, or 4 dimensional data sets, e.g. multiple ‘co-registered’ time series, multimodal image data, space/time data..) via the use of a set of image templates, including:

- single voxels
- linear sequences in cardinal directions (ref.)
- notches in cardinal directions (ref.)
- light cones in cardinal directions and 45 degree angles (ref.)

2. Clustering methods for generating discrete (‘grey’) levels from the constructed feature space (the levels are then typically mapped to the original image space at the anchor points of the templates)

3. Building co-occurrence matrices from a discrete level ‘image’ or a pair of discrete level ‘images’, where the discrete level ‘images’ are typically generated via feature space clustering of the original multimodal data sets (time series, images, space/time data. . .)

4. Estimation of various complexity/texture measures from the co-occurrence matrices. (Haralick measures and epsilon machine related quantities) such as:

- CM Entropy
- EM Entropy
- Statistical Complexity
- Energy Uniformity
- Maximum Probability
- Contrast
- Inverse Difference Moment
- Correlation
- Probability of Run Length
- Epsilon Machine Run Length
- Run Length Asymmetry
- Homogeneity
- Cluster Tendency
- Multifractal Spectrum Energy Range

- Multifractal Spectrum Entropy Range

QUICKSTART

3.1 Installation

```
pip install gentex
```

3.2 Getting started

Here is a dummy example:

First, we create some dummy ndarray (but could be any nd dataset, from an image for example) and a mask.

```
import numpy as np
import gentex

C = np.random.randint(3, size=[5, 5, 5])
maskC = np.ones([5, 5, 5])
```

Then, we compute the GLCM from this array along 2 different offsets

```
offset3 = [[1, 1, 1], [-1, -1, -1]]
cm = gentex.comat.comat_mult(C, maskC, offset3, levels=3)
```

GenTex supports many different type of offsets (rect, conic, angle, distance, etc.). Refer to `gentex.template` for the one available.

Finally, we get a sample of possible statistics extracted from the GLCM

```
texm = ['CM Entropy',
        'EM Entropy',
        'Statistical Complexity',
        'Energy Uniformity',
        'Maximum Probability']
mytex = gentex.texmeas.Textmeas(cm)
for meas in texm:
    mytex.calc_measure(meas)
    print(f'{meas} = {mytex.val}')

CM Entropy = 3.129436250609541
EM Entropy = 1.5849625007211563
Statistical Complexity = 1.584962500721156
Energy Uniformity = 0.117431640625
Maximum Probability = 0.1484375
```

Refer to `gentex.texmeas` for the measures available.

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