

# Sehbau: Matching Vectors

The use of the program for vector matching is explained, called **mvec**. It matches the descriptor vectors of two images (**.vec** files) as generated by the descriptor extraction program (**dscx**), or two focus files (**.vef**) as generated by **focx**. It can be used for any two structures expressed by the vectors, be it a scene, an object, a shape or a texture.

Read <https://www.researchgate.net/publication/377702259>  
Repository <https://github.com/Sehbau/MtchVec>  
PREVIOUS descriptor extraction with **dscx**, <https://github.com/Sehbau/DescExtraction>  
focus extraction with **focx**, <https://github.com/Sehbau/FocExtr>

The directories in the repository contain the following:

- **/Desc** sample vector and focus files (output of **dscx/focx**)
- **/Imgs** sample images
- **/UtilMb** Matlab scripts to read the output data files

The program **mvec** matches the two list of descriptors using pairwise measurements and choosing the nearest neighbor. Two metric measures are available, a dissimilarity and a similarity value, abbreviated **dis** and **sim**, or sometimes also abbreviated as **dist** and **simi**, resp.:

- **dis** returns the Euclidean distance.
- **sim** returns the proportion of matches that are below a fixed threshold value, set with option **[dsc] TolMtc** or **tolMtc** for all descriptor types.

The program can be applied to two vector files (**vec**) as outputted by **dscx**, or to two vector focus files (**vef**) as outputted by **focx**. The combination of a **vec** and **vef** file is not possible yet. The vector files are required to have the same number of levels (pyramid height), otherwise the program returns no results (more flexibility to be included in the future).

The program comes in two variants:

- **mvec1** : matches one pair of images (or focii): one versus one. The Matlab script **runMvec1.m** demonstrates how to deploy the program and read its output. This program is useful for exploring parameter variations.
- **mvecL** : matches a list of images (or focii): one versus multiple. Its use is demonstrated in Matlab script **runMvecL.m**. It outputs only integrated measurements (and not the variety as for **mvec1**). It can be used to match at large scale.

## 1 Program Use

We firstly explain the use of **mvec1**, the matching of two vector files. Their file paths are given as arguments. For example for two image files (**.vec** from **dscx**) we write:

```
mvec1 Desc/img1.vec Desc/img2.vec
```

Or for two focus file (**.vef** from **focxv**):

```
mvec1 Desc/foc1.vef Desc/foc2.vef
```

The vector files are required to have the same number of levels, ie. generated by similarly sized images, otherwise it returns no results. The output is written to **stdout** and will be further explained in Section 2.

For the use of the program **mvecL** we specify a file path and a text file containing the file paths for a list of files to be matched with:

```
mvecL Desc/img1.vec FinasImg.txt
```

This will write the metric measurements into a file named **MesRep.txt** in the same directory. You can specify a different file name by giving a third argument, ie.:

```
mvecL Desc/img1.vec FinasImg.txt MesMtcImg.txt
```

By default, the program matches all descriptor types for the entire pyramid. The options allow to subselect descriptors and levels, as well as to set attribute weight values.

### 1.1 Options

Options can be set by file or by long options (as in case of **dscx**). Again, the use of a file is explained through the Matlab scripts. In the following the use of the long options is explained.

The first list of options set a parameter value to the same value for all descriptor types (Section 1.1.1), which can be unspecific in some cases, but which is convenient for coarse tuning. The second list of options allows to adjust parameters of individual descriptor types for fine tuning (Section 1.1.2).

#### 1.1.1 General (All Descriptor Types):

The following options set values for all descriptor types simultaneously and are useful for coarse tuning. Default values are given in approximate values only, as they are often individual to the descriptor type:

**--tolMtc** [similarity metric]: sets matching tolerance to a fixed value, across all pyramidal levels (and across all descriptor types). This is for the similarity metric only (section **Simi** in output). Default: ca. 0.05.

**--wgtRGB**: sets the weight value for the RGB difference. Set this parameter to zero if chromatic information is irrelevant, for example when places are to be recognized at either day or night. Keep in mind that three difference values are taken (R,G,B) and that this weight parameter therefore has more influence than the others. Default: ca. 1.0.

**--wgtPos**: sets the weight value for the position parameter for each descriptor type. A value of 0 turns off the influence. Default equal ca. 1.0.

#### 1.1.2 Individual (Per Descriptor Type):

**--cntTolMtc**: tolerance for contour matches, for the similarity metric. Fixed value for all levels, but will try to provide something more

flexible. Default: complicated.

**--rsgTolMtc**: tolerance for radial descriptor matches. Analogous to option **cntTolMtc**.

**--arcTolMtc**: tolerance for arc segment matches (see **cntTolMtc**).

**--strTolMtc**: tolerance for straighter segment matches (see **cntTolMtc**).

More in progress.

### 1.1.3 Utility:

**--prms**: displays the parameter values used.

## 2 Output

### 2.1 Program **mvec1**

The results of **mvec1** are written to `stdout` and look as follows:

```
----- desctypes -----
dty  dis      sim
skl  1.357370  0.117928
rsg  1.480588  0.098934
arc  1.489363  0.009344
str  1.351547  0.054755
shp  5.827399  0.048974
eodty.
----- img -----
dis  23.574306
sim  0.000000
eoim.
```

The output lists the measurements per descriptor type and as a total, sections `--- desctypes ---` and `--- img ---`, respectively. The 'end-of' abbreviations `eodty` and `eoim` help identifying the end of those sections more conveniently, see Matlab scripts for examples.

The similarity measure excels in particular for identification of room scenes, as in the task of place recognition. The distance measure performs better for outdoor scenes. More evaluation is in progress.

### 2.2 Program **mvecL**

The results of matching multiple files is written to file as text, and for the moment only a dissimilarity and similarity value are returned. The text file contains four columns, where the first corresponds to dissimilarity and the second to similarity. The third and fourth column are empty (zero) for the moment. Matlab script `LoadMtchMes.m` shows how to load the file.