

## learn

<b>keys:</b>	<b>[from]</b>	<code>&lt;number&gt;</code>	source picture (1 or more layers)
	<b>to</b>	<code>&lt;number&gt;</code>	output picture containing training statistics (multi-layer)
	<b>data</b>	<code>&lt;n1&gt;...&lt;n9&gt;</code>	<i>Plist</i> picture describing training area
	<b>class</b>	<code>&lt;n1&gt;...&lt;n9&gt;</code>	specify a class for a region
<b>options:</b>	<b>verify</b>		type the gathered statistics in detail

The **learn** command calculates the training statistics of polygonal regions. These statistics can be used in supervised classification. Use the **learn** command in *Remote Sensing* applications.

## Examples

```
learn 1 to 20 data 10, 11, 12
```

This command calculates the statistics of areas described by the *Plists* 10, 11 and 12. The statistics are stored in picture 20, with the raw data taken from picture 1.

```
learn 2 to 20 data 10, 11, 12 verify
```

This command performs the same actions as the above command, but also details the number of pixels in each class, sending output to the terminal.

```
learn 2 to 20 data 10, 11, 12, 13, 14 class 1, 1, 1, 2, 2
```

This command calculates the statistics for two classes. The first class contains 3 regions and the second contains 2 regions.

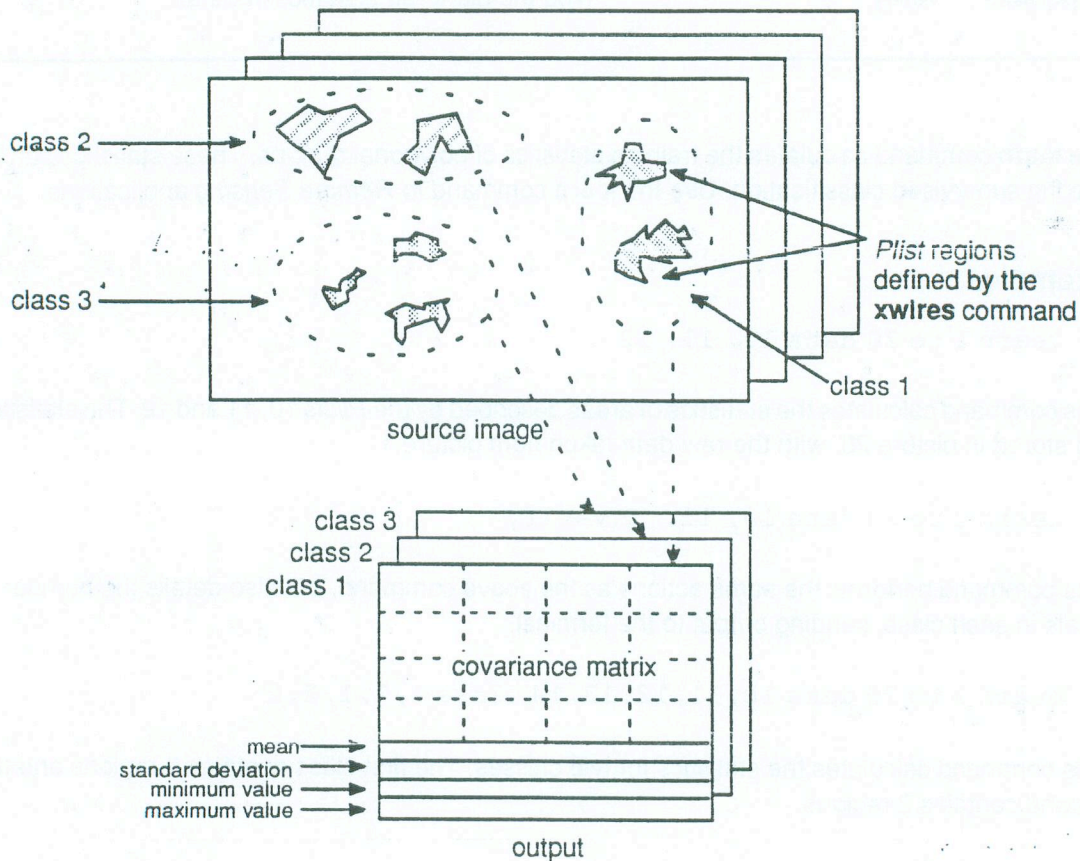
## Description

The **learn** command calculates the statistics of arbitrary polygonal regions, the output of which is suitable for use by the supervised classification commands, such as **box**, **mindistance** and **likelihood**. The statistics calculated for each region are as follows:

- covariance matrix
- mean
- standard deviation
- minimum
- maximum

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**learn** calculates the mean, standard deviation, minimum and maximum for each layer of the source picture. The **data** key specifies the *Plists* which describe the polygon, or *training region*. (These describe the area for which the statistics are calculated). You can specify up to nine polygons in a comma separated list using the **data** key. If you require more than nine polygons, use the **stack** command to combine the result of several **learn** commands. The region's statistics are stored in a separate layer of the output picture specified by **to**. The following diagram illustrates the typical operation of the **learn** command.



By default, each training region belongs to a separate *class*. Use the **class** key to specify that a class contains more than one training region. There must be the same number of **class** keys as **data** keys, for example:

```
learn to 999 data 3,7
```

specifies 2 regions and therefore requires 2 classes. The command:

```
learn to 999 data 3, 4, 5, 6
```

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specifies 4 regions. Classes can be numbered from one up to the number of regions specified by the **data** key.

If you specify the **verify** option, **learn** outputs the number of pixels that it finds in each class to the console. **learn** displays an asterisk (\*) beside a class which does not have enough data for the maximum likelihood classification (if the number of pixels in the training region is less than ten times the number of layers in the source picture). If statistics are calculated from too small a training region, the covariance matrix is likely to be singular (no inverse) and the maximum likelihood classification method cannot be used. See the **likelihood** command for details of the maximum likelihood classification.

The **learn** command estimates the maximum number of pixels in each region in order to create a temporary picture. This temporary picture contains the pixels of an area whilst its statistics are calculated. It is possible for **learn** to fail if there is not enough space for the temporary picture on disc. (Use the **compress** command to gather free disc fragments). **learn** may also fail in the unlikely event that the maximum number of pixels is estimated incorrectly. This situation is only likely to occur if you supply very long, thin horizontal training regions. Note that the **learn** command sets as many of the variables (*area*, *ar2*, *ar3*, *ar4*, *ar5*, *ar6*, *ar7*, *ar8* and *ar9*) as there are classes. The variables are set to the number of pixels found in each class; use the **verify** option to see these values.

#### Notes

variables set: *area*, *ar2*, *ar3*...*ar9* (number of pixels found in each class)  
see also: **box**, **compress**, **likelihood**, **mindistance**, **stack**

#### Defaults and Ranges

keys/options	defaults	range
<b>[from]</b>	current picture, held in the variable <i>select</i>	valid picture number
<b>to</b>	<i>none</i> , specify an output picture	valid picture number
<b>data</b>	<i>none</i>	positive integer
<b>class</b>	each region is associated with a separate class	positive integer
<b>verify</b>	verification off	