**Listing of all functions in the MATLAB toolboxes**

**util**

**Data structure functions**

|  |  |
| --- | --- |
| addstruct | Adds a data structure to another - field by field |
| dload | Loads a column-oriented ascii-data file into memory |
| dprint | Prints data structure on screen |
| dsave | Save a data structure as a data file with headers (ASCII) |
| dsort | Sorts a data structure according to some fields |
| field\_matrix2vector | Transforms a matrix in a structure to n vectors |
| field\_vector2matrix | Changes vectors var1,var,... back into matrix var |
| getcol | Returns col(s) x from a data structure |
| getrow | Returns row(s) x from a data structure |
| insertrow | Insert row(s) at position x into a data structure |
| setrow | Sets row(s) x in a data structure |

**Other data manipulations**

|  |  |
| --- | --- |
| SSQ | Sum of squares of X |
| extrema | Gets the global extrema points from a time series. |
| extrema2 | Gets the extrema points from a surface. |
| fillSparse | Fills a sparse matrix with missing values (NaN) with row and column means |
| findIdx | Finds indices based on several criteria combined by and/or |
| findrow | Finds a row of certain values in a Matrix |
| fisherinv | Inverse of fisher-z |
| fisherz | Fisher-z transformation of correlation |
| isincluded | Which elements of SetB are included in SetA? |
| kernel\_est2D | Gives a kernel estimate of the underlying density and underlying function z |
| maxindx | Turns around arguments from max |
| maxtime | Returns the maximum of a vector |
| minmax | Returns the minimum or maximum of a vector, whatever is larger in absolute value |
| nancount | Returns the number of values that are not NaN |
| nanplus | Adding two matrices, but ignoring NaN-entries |
| rotationMatrix | returns a affine transformation matrix, which rotates a 2-dimensional coordinate by angle degrees |
| sample\_wor | Draws a sample WITHOUT replacement from the vector X |
| sample\_wr | Draws a sample WITH replacement from the vector X |
| shift\_matrix | Returns a matrix B, in which A(r,c) is located at B(1,1) and the rest of the entries are shifted |
| split\_data | Splits ordinal data into p categories |
| table2vector | Transforms a m\*n matrix to a vector with the X matrix as row and column signifier |

**Input / output functions**

|  |  |
| --- | --- |
| fcneval | Evaluates a function, while dealing with possible complex strings |
| get\_response | Waits for user input |
| progress\_bar | Progress bar for the command prompt |
| struct2list | Transforms a structure into an argument list |
| vararginoptions | Deals with argument lists passed to functions |

**Others**

|  |  |
| --- | --- |
| choose\_rnd | Chooses a random multinomial variable |
| get\_files | Resolves the \* file naming convention |

**timeseries**

**Time series functions**

|  |  |
| --- | --- |
| oofnoise | Creates a power spectrum |
| ppFT | Takes the fourier transform of a point-process at the frequency ft's |
| ppMakeTs | Transforms a point process into a time series |
| ppPoisson | Returns a point process in a poisson fashion |
| tmCoherency | Uses computational the crosscovaraince or covariance function of the times series and computes the Power spectrum of the empirical fourier transform of F=tsFT(TS) – uses tsSpectrum |
| tmFFT | Makes a frequency object |
| tmFSpace | Takes the frequency-space from -pi to pi, excluding -pi |
| tmFT | Makes a frequency object |
| tmIFT | Based on the slow inverse fourier transform |
| tmSpectrum | Uses computational the crosscovaraince or covariance function of the times series and computes the Power spectrum of the empirical fourier transform of F=tsFT(TS) – uses tsSpectrum |
| tmXcorr | lag -1 is a(2:end)~b(1:end-1) |
| tsAcf | ??? |
| tsFFT | Creates a frequency object, wrapper for FFT, returns the same as tsFT |
| tsFSpace | Takes the frequency-space from -pi to pi, excluding –pi, returns the Fourier frequencies for a time vector |
| tsFT | Creates a frequency object, by-foot Fourier transform |
| tsIFT | Creates a time-series object from frequency object |
| tsPlot | Plots a univariate or multivariate time series |
| tsPrewhite | Prewhitening of a time-series |
| tsRand | Generates a real random time series on the time vector t |
| tsSpectrum | Uses computational the cross covaraince or covariance function of the times series and computes the Power spectrum of the empirical fourier transform of F=tsFT(TS) |
| tsTaper | Returns a tapered version of the timeseries T |
| ts\_dyn\_spectrum | Returns a dynamic spectrum of a time series (does cross-spectrum, if more series than one) |
| tseffectivedf | Returns the effective df from a estimated Power-spectrum |

**Frequency functions**

|  |  |
| --- | --- |
| fsPlot | Plots the imaginary and real part of function fsPlot(F) (frequency plot) |
| fsPower | Computes the Power spectrum of the empirical fourier transform of F=tsFT(TS) |

**Other functions**

|  |  |
| --- | --- |
| acf | Gives back the autocorrelation function of x, lag 0-n-1 |
| acfSig | Delivers the signifcant deviation of some autocovariance function on the lags 1-k |
| acf\_expsampl | Returns the expected sample autocovariance function from a theoretical one |
| avrgIRF | ??? |
| cof | Gives back the covarince function function of x, lag -n-1:n-1 |
| complexdemod | Gives back the complex demodulation of timeseries (vector) on the frequency 1/period |
| crosscorr | Finds the highest cross-correlation between two vectors and the lag. |
| demod | Signal demodulation for communications simulations. |
| fdynSpectrogram | Takes a dynamic spectrum or cross-spectrum and makes a spectrogram plot |
| filter1 | Filter from homework one, y(1)=(x(t-1)+x(t)+x(t+1))/3 |
| first\_diff | Takes the first difference of the time-series t |
| gAnova | Runs a regression of the cut-out IRFs of a timesseries |
| hos\_oriv | Parameter estimation of a timevariant MA(q)-model by Friedlander's ORIV-algorithm |
| irfANOVA | Runs an anova over the fourier transforms |
| irfANOVA\_m | Runs an anova over the fourier transforms |
| irfAvgr | ??? |
| irfEstimate | Calculates the impulse response function |
| irfMC | Runs a monte carlo study of the irf-analysis |
| irfTP | As: function from the single pulse-experiment |
| ma1model | MA(1)-Model with variable parameter b=-3(0.1)3 |
| ma1show | Sinus shape of the parameter b |
| ma1sinus | MA(1)-Model with sinus shaped parameter b |
| makeConvM | Creates convolution matrix from a |
| makeTS | Creates a time-series starting at zero |
| mod\_mom | Parameter estimation of a timevariant MA(q)-model by extension of |
| mom3 | Estimation of the third order moment sequence cX(n,m) for n,m=-q:q |
| moveavrg | Moving average function |
| spm\_fMRI\_design\_one\_reg | Assembles a design for fMRI studies |

**stats**

**Random numbers**

|  |  |
| --- | --- |
| choose\_rnd | Chooses a random multinomial variable |
| sample\_wor | Sample without replacement |
| sample\_wr | Sample with replacement |

**Fitting and sampling functions**

|  |  |
| --- | --- |
| EM\_run | Executes an iterative expectation maximization fit on the data using control parameters |
| detrend\_poly | Detrends with a set of legendre-polynomials |
| mcmc\_sample | Markov chain Monte Carlo sampling |
| mcmc\_test | Test function for mcmc\_sample |

**Linear models**

|  |  |
| --- | --- |
| Anova1\_glm | Conducts a 1-dimensional ANOVA |
| Anova2\_glm | Conducts a 2-dimensional ANOVA |
| MANOVA1 | One factorial MANOVA |
| MANOVA1\_short | One factorial MANOVA |
| MANOVA2 | Two factorial MANOVA |
| MANOVArp | One factorial repeated measures MANOVA |
| anovaMixed | Repeated measures ANOVA with within and between factors |
| ard\_test | univariate test |
| checkMANOVArp | Does monte carlo on MANOVArp |
| ML\_constrained | constrained maximum likelihood estimation of regression parameters |
| ML\_constrained2 | Mstep: Constrained regression |
| ML\_constrained\_fast | constrained maximum likelihood estimation of regression parameters |
| ML\_constrained\_test | Test constrained ML estimation |
| MakeorthG | makes orthogonal G-matrix as described |
| linintercept | Intercept from linear regression with intercept |
| linregress | Linear or multiple regression |
| linslope | Slope from linear regression with intercept |
| lm | Linear fixed,random and mixed effects models |
| lmcontrast | calculates a contrast on an estimated linear model |
| mixed\_model | Estimates the fixed and random model coefficients for a mixed model |
| ttest | paired, independent and one-sample t-test |
| variance\_components | Returns the variance components |
| wilks\_lambda | Calculates Wilk's Lambda for multivariate ANOVA |

**Other models**

|  |  |
| --- | --- |
| PCA | simple PCA implementation with graphical output |
| ROC\_calculate | Calculate an ROC curve for different levels of sensitivty |
| factoranalysis | Implementation of EM algorithm for factor analysis |
| gaussian\_mixture | Model-function for gaussian mixture models |
| gaussian\_mixture\_loglikelihood | Model-function for gaussian mixture models |
| hotellingT2\_nick | Computes the Hotelling T^2 multivariate statistic |
| kalmanfilter\_steadystate | Implementation of Kalman filter |
| kernel\_est | Gives a kernel estimate of the underlying density of x and underlying function z |
| kernel\_est2D | Gives a kernel estimate of the underlying density of x and underlying function z |
| logistic\_liklihood | Returns the logistic likelihood |
| logistic\_regress | Logistic regression implemented over IRLS |
| logistic\_regress\_test | Balanced design 1 |
| logistic\_resp\_func | Returns the logistic response function |
| lwr | Uses locally weighted regression to fit |
| mises\_mixture | Model-function for vanMises mixture models (on sphere) |
| mises\_pdf | vanMises distribution |
| mises\_pdf\_test | Test function for mises\_pdf |
| mises\_uniform\_mixture | Model-function for mises mixture model with one mises mixture known |
| pPCA | Probabilistic PCA |
| pPCA\_example | Probabilistic PCA |

**Gaussian processes**

|  |  |
| --- | --- |
| gp\_covCond | Condition-based covariance function |
| gp\_covRun | Squared Exponential covariance function with isotropic distance measure |
| gp\_kernelRun | Squared exponential Kernel |
| gp\_kernelSE | Squared exponential Kernel |
| gp\_regression | Gaussian process regression (see Rassmussen and Williams) |
| gp\_regression\_margeliklihood | Returns negative marginal likelihood of regression model |
| gp\_regression\_optimhyper | Gaussian process regression (see Rassmussen and Williams) |
| mva\_GPdrift | (see Rassmussen and Williams) |
| mva\_gpr | Gaussian process regression, with a named covariance function |

**Multivariate pattern decomposition**

|  |  |
| --- | --- |
| mvpattern\_covcomp | Estimate random-effects variance component coefficients |
| mvpattern\_covcomp\_diffvar | Estimates the variance coefficients of the model |
| mvpattern\_covcomp\_my |  |
| mvpattern\_covcomp\_old |  |
| mvpattern\_full | Returns a full set of constraint matrices for unconstrained estimation of a QxQ covariance Matrix |
| mvpattern\_getpatterncomp |  |

**Others**

|  |  |
| --- | --- |
| ard\_bases | Linear regression??? with automatic relevance detection |
| ard\_bases\_alt | Linear regression??? with automatic relevance detection |
| ard\_linregress | Linear regression with automatic relevance detection |
| ard\_mva | Linear regression??? with automatic relevance detection |
| blockdiag | returns the block diagonal |
| canonicalcorr | Computes canonical correlation between X and Y |
| effectvar | Does effect coding a on vector |
| legendrep | Constructs Legendre polynomial Pm(x) |
| make\_designmatrix | Makes a design matrix following a formula structure |
| mindeviation | Returns the minimal deviating value of a vector |
| normll | Returns the log likelihood of normal distribution |
| normpdf\_v | Returns the scalar probability of a multivariate Gaussian |
| rANOVA | ??? |
| reml | Restricted Maximum Likelihood estimation of model X |
| remlYY | Restricted Maximum Likelihood estimation of model X |
| remlYY\_wls | Restricted Maximum Likelihood estimation of model X |
| robustmean | Calculates the robust mean of a vector |
| softmax | Returns softmax response function |
| spectral\_clustering\_test | Testing of spectral clustering |

**Kinematics**

**Numerical derivatives and smoothing**

|  |  |
| --- | --- |
| acceleration\_discr | Numerical second derivative (with filter option) |
| kalmanfilter | Implementation of Kalman filter |
| kalmanfilter\_vel | Implementation of Kalman filter for velocity |
| savgolay | Savitsky-Golay smoothing. This smoothing technique fits a polynomial |
| smooth\_kernel | Gaussian kernel smoothing (1-dim) |
| tangvelocity | Tangential and vector velocity from position data |
| velocity\_discr | Numerical first derivative (with filter option) |

**Landmarking, cutting, and stretching**

|  |  |
| --- | --- |
| cut | Cuts out a kinematic trajectory for placement in matrix |
| findend | Generic funcion to find the end in a trace |
| findstart | Generic funcion to find the start in a trace |
| findzero | Finds vector of zero crossings in a velocity-vector |
| lengthstandard | Standardizes the length of each vector |
| tracerealign | Returns a realigned version of the timeseries in T |

**Data file handling**

|  |  |
| --- | --- |
| movload | Loads a mov file, parsed into single trials |
| openmovfile | Opens a movement-file and reads the first line("trial") |
| readmovfile | Loads a new trial from mov-file |

**Graph**

**Single plot operations / utility functions**

|  |  |
| --- | --- |
| confidelps | Draws confidence-ellipse over the x,y sample |
| drawline | draws vertical or horizontal reference lines |
| drawpatch | draws a patch of certain shape |
| errorbars | Adds errorbars to bargraphs |
| herrorbar | Horizontal Error bar plot. |
| kernel\_est | smoothing with a Gaussian kernel over neighborhood |
| lineplot | Lineplots from raw data |
| makeglabels | Makes group labels for boxplots, etc. |
| makexlabels | Makes labels for the x-axis of Grouped graphs |
| plot\_ellipse | Plots an ellipse |
| plotlegend | Helper function to generate legend with the option to have leg='auto' |

**Standard plots from raw data, many formatting options**

|  |  |
| --- | --- |
| barplot | Barplots from raw data |
| circhist | Does a phase histogram between -180 and 180 (circular histogram) |
| hist\_double | Overlays the histograms for two variables |
| hist\_pivot | Makes M\*N subplots with histograms, depending on categorial variabels |
| histdistn\_plot | Overlays a histogram with a distribution function (ccaled) |
| histplot | Combines functionality of a hist\_pivot and hist\_double |
| imagesc\_rectangle | Displays a matrix as an image consisting of rectangles |
| myboxplot | Boxplots with formatting options |
| myboxutil | Produces a single box plot. |
| plotshade | Plots times series with +-SD as transparent underlay |
| scattermatrix | Matrix of scatterplots to access dependency of variables |
| scatterplot | Scatterplot with formatting/splitting options |
| traceplot | Plotting of multiple time series with formatting options |
| traj\_plot | Plots trajectories in 2D |
| trialscatter | Scatter of a time series of experimental trials with block boundaries |
| xerrorbar | Error bar plot. |
| xyplot | Plots a variable against another using x and y error bars |

**Multivariate surface plots**

|  |  |
| --- | --- |
| contour\_kernel | Makes a contour plot from a kernel estimate |
| contour\_pivot | Makes a contour plot from a pivot-table |
| hist2d | Make 2d histogram or density estimation plot |

**Formatting**

|  |  |
| --- | --- |
| figure\_scalesubplots | Scales all subplots to the same axis-limits |
| figure\_scaleysubplots | (Scales all subplots to the same axis-limits |
| wysiwyg | Present Figure on Screen as it is printed |

**Pivot**

**Pivot table functions**

|  |  |
| --- | --- |
| pivottable | Returns a pivot table with (Rows-signifier, column-signifier, ) |
| tapply | Condenses a Data structure into another |

**Utility functions**

|  |  |
| --- | --- |
| fac2int | Conversion of string-valued variable (factor) into intergers |
| int2fac | Backwards conversion |
| pidata | Returns the data sorted ready for a pivot table in a cell array |
| print\_pivot | Formatted output on screen |

**Example functions for field commands**

|  |  |
| --- | --- |
| mycorr | correlation coefficient |

**Circ**

|  |  |
| --- | --- |
| circmean | Mean of circular data (radians) |
| circmeandeg | Mean of circluar data (degrees) |
| circvar | Variance of circluar data |
| circstd | SD of circluar data (radians) |
| circstddeg | SD of circluar data (degrees) |
| circvelocity | First Derivate (adjusts for wrapping, radians) |
| circvelocitydeg | First Derivate (adjusts for wrapping, degrees) |
| diffang | Subtracts two angles and keeps result in [-180,180] |
| unwrapdeg | Unwrap for measures in degrees |
| circ\_pipi | Keeps angles between -pi and pi |
| circ\_cosinemodel | Circular distribution function |
| circ\_cosinemodelcost | Cost for fitting on circular data |