How to write reports

Abstract

This is how an answer to the "problem" of estimating mean and variance (the same one that is used in the "how to mex" example) may look like.

The code below has been used to simulate samples of sample size $N = 10, 20, ..., 1000$ from a $N(\mu, \sigma)$ distribution, with $\mu = 1$ and $\sigma = 2$. For each of the samples the mean and standard deviation were estimated and recorded. The results are displayed in Figure 1.

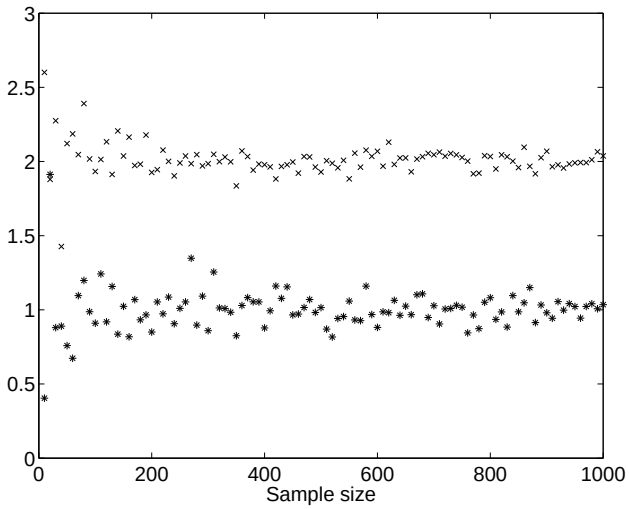

Figure 1: The convergence of the sample standard deviation (crosses) and mean (stars).

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%% The main function, Matlab
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

n = 10:10:1000;                 %%% The sample sizes
A = zeros(length(n),2);
for i = 1:length(n)
    par = [1,2];                %%% The true parameters
```

```
    a = mex_ex2([1,2],n(i));    %%% The estimates
    A(i,:) = a;
end

close all
plot(n, A(:,1),'*',n,A(:,2),'x')
xlabel('Sample size')

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%%% Function that calculates the estimates. C/Matlab, through mex.
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

/*Function mex_ex2.c*/

#include "mex.h"
#include <math.h>
#include <stdlib.h>
#include <gsl/gsl_rng.h>
#include <gsl/gsl_randist.h>
#include <gsl/gsl_statistics.h>
#include <gsl/gsl_cdf.h>
#include <fcntl.h>

/*Returns the seed for the random number generator*/

unsigned int devrand(void)
{
    int fn;
    unsigned int r;
    fn = open("/dev/urandom", O_RDONLY);
    if (fn == -1)
        exit(-1); /* Failed! */
    if (read(fn, &r, 4) != 4)
        exit(-1); /* Failed! */
    close(fn);
return r;
}

/*Estimates the mean and the variance*/

void mean_var_est(double *par, int N, double *val)
{

long seed = devrand();
gsl_rng *r = gsl_rng_alloc(gsl_rng_mt19937);
```

```
gsl_rng_set(r,seed);

double *v;
v = malloc(N*sizeof(double));

int i;
for (i = 0; i < N; i++)              /* Simulates the random sample */
{v[i] = par[0]+gsl_ran_gaussian(r,par[1]);}

val[0] = gsl_stats_mean(v,1,N);      /* Estimates the mean and std */
val[1] = sqrt(gsl_stats_variance(v,1,N));
}


/* The gateway function */

void mexFunction( int nlhs, mxArray *plhs[], int nrhs, const mxArray *prhs[])
{
    double *par, *val;  /*par - [mu, sigma], val - [mu_hat,sigma_hat]*/
    int N;              /*N - the sample size*/
    par = mxGetPr(prhs[0]);
    N = mxGetScalar(prhs[1]);
    plhs[0] = mxCreateDoubleMatrix(1,2,mxREAL);
    val = mxGetPr(plhs[0]);

    /* call the computational routine */
    mean_var_est(par,N,val);
}
```

As can be seen from the figure, the variance of the estimators decreases with increasing N and they converge to the true values of the estimated parameters. This illustrates that the empirical mean and standard deviation are indeed consistent estimators of their theoretical counterparts.

In other words, your answer should include a short descriptions of what you have done, your result (in this case a graph), your code and, finally, an explanation of the result, i.e. what does it tell you. A few points to note:

- *The font in the figure is large enough for the reader to be able to see what is written without a microscope*
- *The different lines in the plot are indicated by different markers rather than different colors, the advantage being that you can still see what is what even in black-and-white print*
- *All of the code fits on the page*

- *There are explanatory comments in the code. Need not be on every line, but at least beside all declarations of important variables and functions*
- *The spelling and grammar may not be perfect, but at least you shouldn't get a merry green-and-red Christmas coloring if you copy-paste it into Word*
- *If you use the same code/function to answer several questions, do not write out that code several times. Have it in one place and then simply refer to it.*