Numerical Optimisation Assignment 6

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Exercise 1

Submitted via cody coursework.

Exercise 2

(1) solverCM2dSubspaceExt.m
(2) solverCM2dSubspaceExtLS.m

Depending on the form of the Hessian passed into the function (2) will create a function handle for the approximated Hessian. Also, need to find the minimum eigenvalues of the Hessian for both. (2) does this iteratively for larger Hessian matrices whereas (1) has no such safeguard. For (2) there must also be a check for indefinite Hessian as done in line 50. Then for (2) a modified conjugate gradient method is used to solve for inv(B)*g when the approximated B has negative eigenvalues. When B has positive, for (2) a relative residual factor norm(g) is calculated for the MCG when solving for inv(B)*g.

Exercise 3

Method	**Line Search c1**	**Line Search c2**	**Alpha0**	**Maximum # of Iterations**	**Tolerance**	**eta**	**Delta**
Newton LS	1e-4	0.5	1	200	1e-5	~	~
BFGS	1e-4	0.5	1	200	1e-5	~	~
Trust Region SR1	~	~	~	200	1e-5	0.1	1

Table of Parameters for All Methods of Optimisation

Method	**Time Elapsed for Minimisation (seconds)**
Newton LS	12.9134
BFGS	2.4241
Trust Region SR1	48.3482

Table Summary of Minimisation Times

Note that BFGS is by far the most efficient in finding the minimisation for this problem taking far less time when compared to Newton-LS and Trust Region SR1.
BFGS can be done at the cost of , plus any cost of functions can gradient handlers. The rate of convergence of BFGS is superlinear. Although Newton LS has quadratic convergence the computation cost is much higher due to its requirement of the second derivative.
The Trust Region SR1 has an advantage for generating good Hessian approximations. In this case, a Hessian is already known. With a complex function like in this case, it may be possible that superlinear convergence can be missed because of poor Hessian approximation. Along with the computation cost, it results is long convergence times for this problem.

A)

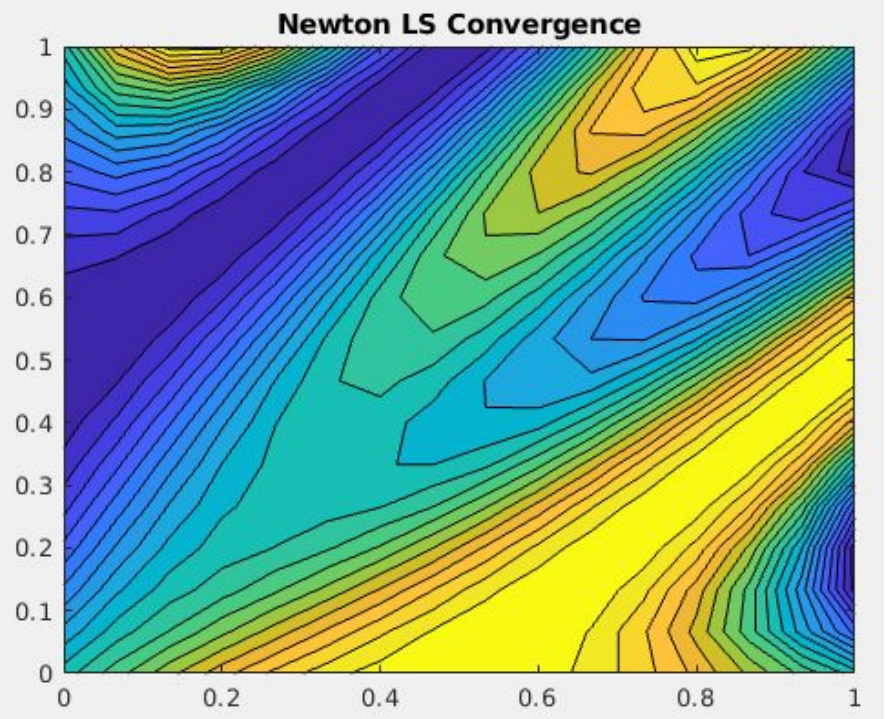

Figure 1: Newton LS

B)

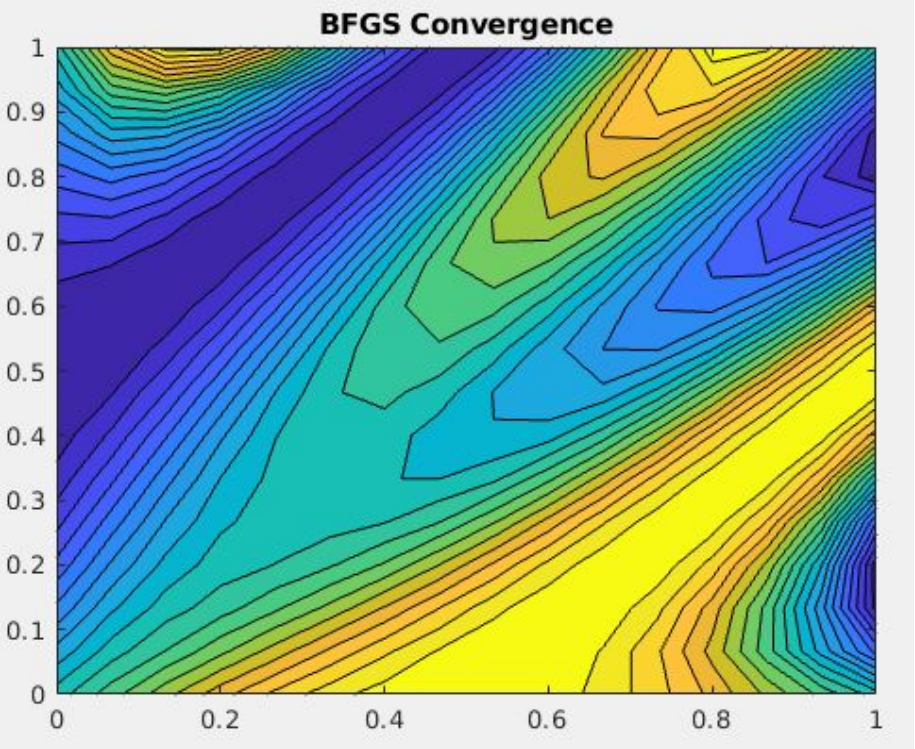

Figure 2: BFGS

C)

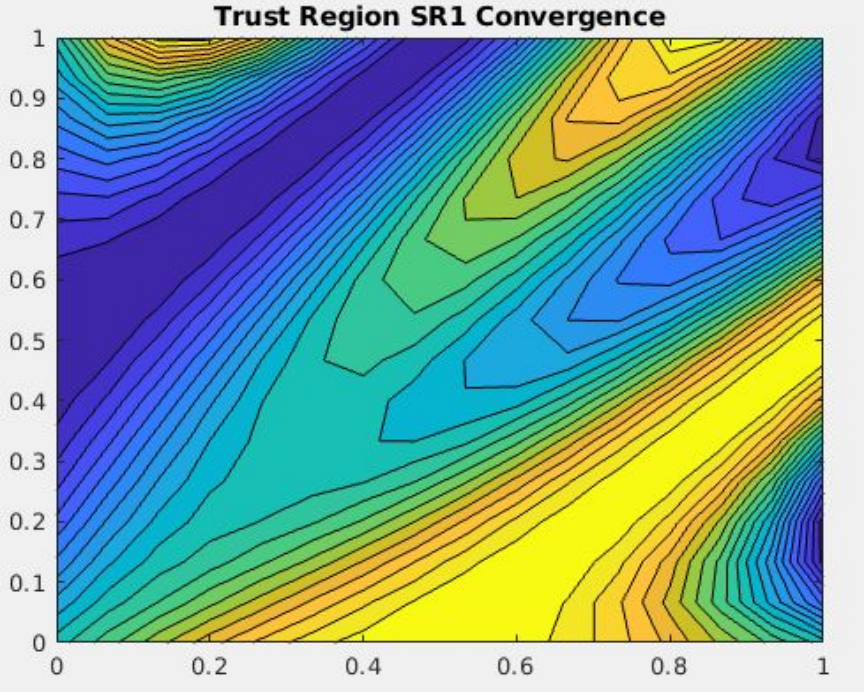

Figure 1: Trust Region SR1