Optimization 2016. List of projects

Overlook of modern optimization problems and methods

Research the following topics, using online sources. Write an short (2-4 pages) report explaining the principle of the approach and illustrate it with an example. Prepare a ten minutes class presentation. Address the following: What kind of problems can these methods solve?

1. Discrete optimization. Traveling salesman problem: statement and methods. (You may use `http://www.csd.uoc.gr/~hy583/papers/ch11.pdf`)

2. Pareto optimization: Concept of Pareto efficiency, Pareto front. Compare with Lagrange multipliers techniique

3. Genetic algorithms: Initialization, Selection, Genetic operators, Termination, The building block hypothesis

4. Stimulated annealing. (You could use examples from http://csg.sph.umich.edu/abecasis/class/2006/615.19.pdf and http://www.theprojectspot.com/tutorial-post/simulated-annealing-algorithm-for-beginners/6)

5. Stochastic algorithms. Use https://arxiv.org/pdf/0704.3780.pdf.

6. Find minimum of $f(x, y, z)$ for any method:

$$f = |y|^{3/2}|x|^{2/3} \left(1.5 - \cos\sqrt{100|x| + \frac{z}{y + 2.5}}\right) - .2\cos(6x)\cos(9y)e^{-z}$$

$$x \in [-2, 2], y \in [-2, 2], z \in [-1, 0]$$

Justify the choice of the method.

7. Solve (numerically) a boundary value problem

$$(e^{x^2 u''})'' = 1, \ u(0) = u'(0) = 0, \ u(1) = 1, u'(1) = 2$$

by the shooting method: (a) solve (numerically) the above DE with the initional conditions: $u(0) = u'(0) = 0$, $u'' = a$, $u''' = b$, and (b) choose a and b to minimize the function

$$f = (u(1) - 1)^2 + (u'(1) - 2)^2$$

Comment: You may want to repace the fourth-order DE with an equivalent system of first-order DEs.

Please indicate your preferences. The projects will be assigned in the class. You can also use the project you are working on for the dergee, if you have one.