Majdi Rabia's thesis, entitled "Numerical Methods for High Dimensional BSDEs" explored existing computational methods and newly proposed ones for an established theory: the High Dimensional Backward Stochastic Differential Equations.

This thesis follows a standard structure of a Master thesis, and I think the contents are sufficient for a Master degree. The follows are some suggestions for the student to conduct some minor revision.

1. "Abbreviations" need to be defined first before using, and I suggest not to put them in the title of a Section. There are also others, such as BSDE (the title of Section 1.2)

   For example. SDE is the title of Section 1.1 but not defined at all before this point. What do "r.v.", "s.t.", "a.s" mean? I know they are popularly used notations in the literature, but I still think they need to be defined before using so that the thesis is self-contained.

2. Some presentations are not very clear to me. For example, I can not quite follow how the "Mesh Method" described in Section 4.1 really works. In particular, what does "we omit the connection between the paths nodes, i.e. we forget which node at time step j generates the one at time j+1" really mean?

3. In the application chapter (Chapter 5), more explanations of the data stucture, background, and why the methods are suitable to analyze the data are necessary.

4. There are typos and grammar mistakes throughout the thesis. So some careful proof-readings and edits are necessary to ensure the appropriate usage of the language.

Report on
"Numerical Methods for High Dimensional BSDEs"
by Majdi Rabia

Majdi Rabia submitted a MSc thesis describing several numerical methods for the computation of BSDEs. The thesis mainly consists of three parts. The first part discusses the basic concepts of BSDEs. The second part illustrates some numerical methods for the computation of conditional expectation. The last part demonstrates these methods by applying them to option pricing problems.

Comment

The topic of this thesis is very interesting. A wide range of statistical methods are introduced for the computation of BSDE, which is usually considered only in a mathematical viewpoint. On the other hand, the writing is not very clear after Chapter 2. In the following, I will list a few issues found during my reading.

1. P1, $(\mathcal{F}_t)_t$ should be $\mathcal{F}_t$. Please check the notation $\mathcal{S}^2$ is correct, as it has nothing to do with square.

2. P1, SDE is an acronym. You should not use it as a section title, and you should spell out its meaning the first time you mention it.

3. P1, "A strong solution of 1.1". For all equation numbers, you should add parenthesis, as they are defined.

4. P1, (1.1), (1.2) and most displayed equations: you need proper commas and periods for your equations.

5. P2, (1.3) Do you need the value of X_0? What does Z_t stand for?

6. P2, 1.2.2, first paragraph, what do you want to achieve through these methods?

7. P3, 2.1.1, what is π in X_i^π? And what is Δt?

8. P4, what is "Proof"? What do you want to prove? Why there is a lemma inside a proof? And is δt the same as Δt?

9. P5, Theorem 1. Do you prove this theorem? Else provide a citation.

10. P6, 3.4.1, what do you mean by $Y_{t_n} = \xi(S_{t_n})$? Is ξ a function instead of a given random variable?

11. P7, last displayed equation, shouldn't it be $f(t_i, S_{t_i}, Y_{t_i}, Z_{t_i})$?

12. P8, there is a huge logic gap between Chapter 3 and Chapter 4. Why do you want to do regression? You need to mention that conditional expectation is needed in the computation of BSDEs, and you apply regression methods for that purpose.

13. P8, how to do the mesh method for backward process is completely unclear from your writing.

14. P9, "Likelihood Ratio" , and $g(t_i, X_i)$.

15. P10 Before Section 4.2, what does "..." mean?

16. P12 The main issue here is that the random forest method is only mentioned, but not defined or introduced. Through Definition 4.3.1-4.3.5, you define what is a tree. You should define the random forest method with the same amount of details. Appendix B also fails to achieve this task.

17. P14 Algorithm 2, line 5, what is "_ _"? What is the purpose of this for loop?

18. P17, Table 4.1 caption: n_{picard}.

19. P19, equation (5.5). What does . stand for? What is Φ_t as you only have Φ_t^i previously. What is $\mathbb{1}$?

20. P45. The definitions of Bias and Variance are clearly weird and incorrect.

21. P47. You should define or illustrate what is a random forest first. Else all the material here is completely useless for the reader.