POEMA

Meeting Type	*Online Learning Weeks*
Date	*27 May 2020*
Time	*16:00 – 17:30 CEST*
Talk	*Polynomial Optimization*
Lecturer	*Didier Henrion – LAAS-CNRS*
No of attendants	*116*

1. Questions during the course

- Any condition to get strong duality?
- so p_r^* should be a lower bound for p^*?
- Could you show an example or Q_p,r for some small dimension?
- There was a g1(x) at some point, was it meant to fulfill the archimendian assumption?
- How is the state of the theory of Lasserre hierarchy relaxations with respect to a possible application to convergent power series instead of polynomials? Out of the generic case (and maybe also in the generic case), is it possible to decide a priori an optimal bound for r so the computations are tractable and the approximations are good enough?
- Can you please consider a real time discrete dynamical system
- If the constrains of the optimisation problem are rational functions, is there a way to relax the problem to a SDP problem?
- What kind of convergence results (if any) are available if the semialgebraic set X is not compact?
- When does this approach make sense as opposed to techniques using cylindrical algebraic decomposition?
- How do these techniques scale, especially to large numbers of variables (and possibly constraints), possibly assming the constraints are not very "difficult" (maybe have some common structure)?
- Will we see some examples in the next lectures? Otherwise which are some references for the case of rational function constrains? Is there a software that does the SDP relaxation of this case?
- if there is a group G acting on K and the cost function is invariant under G, can we use this information to make things easier?
- Is it in some cases possible to combine problem sparsity with the symmetry approach (from Yang qi's question), to reduce the problem even further?
- Is there software to solve Flag-SOS?
- In gloptipoly, how is the absence of a user defined ball constraint handled?
- Is the work on symmetric polynomials (i.e. replacing x with y and y with x gives the same polynomial), which may strongly reduce the space of polynomials to consider?

- Other than Lasserre hierarchy which are other common approaches to PolyOpt?
- Is there a general estimate for the necessary radius bound R, or just for specific problems?
- What are some applications of optimization on symmetric polynomials?

2. The chat history

- Selma Djelloul: what are typical problems solved using those techniques
- Jan Ramon: are slides available so we can reread definitions we forget?
- Monique Laurent: Any condition to get strong duality?
- ddt00: so p_r^* should be a lower bound for p^*?
- Michal Kocvara to everyone: Could you show an example or Q_p,r for some small dimension?
- Devesh Adlakha: There was a g1(x) at some point, was it meant to fulfill the archimendian assumption?
- Prof M. L. Karangini: Can we please get the solutions for the Exercise for checking?
- Alejandro Gonzalez Nevado: How is the state of the theory of Lasserre hierarchy relaxations with respect to a possible application to convergent power series instead of polynomials? Out of the generic case (and maybe also in the generic case), is it possible to decide a priori an optimal bound for r so the computations are tractable and the approximations are good enough?
- Prof M. L. Karangini: Thank you for nice presentations. Please, can you please consider a real time discrete dynamical system.
- Annachiara Korchmaros: If the constrains of the optimisation problem are rational functions, is there a way to relax the problem to a SDP problem?
- Giovanni Fantuzzi: What kind of convergence results (if any) are available if the semialgebraic set X is not compact?
- Robert Hildebrand: When does this approach make sense as opposed to techniques using cylindrical algebraic decomposition?
- Jan Ramon: How do these techniques scale, especially to large numbers of variables (and possibly constraints), possibly assming the constraints are not very "difficult" (maybe have some common structure)?
- from Annachiara Korchmaros: Thank you, follow up question: will we see some examples in the next lectures? Otherwise which are some references for the case of rational function constrains? Is there a software that does the SDP relaxation of this case?
- Yang Qi: A very naive question: if there is a group G acting on K and the cost function is invariant under G, can we use this information to make things easier?
- Fabrício Caluza Machado: Annachiara Korchmaros, look at https://arxiv.org/abs/1811.05439 , page 9
- Sven: Is it in some cases possible to combine problem sparsity with the symmetry approach (from Yang qi's question), to reduce the problem even further?
- Daniel Brosch: Is there software to solve Flag-SOS?
- Victor Magron: For the convergence speed: https://www.math.uni-konstanz.de/~schweigh/publications/putcompl.pdf
- Victor Magron: @Sven: I believe that you can start with symmetries and then apply sparsity
- Devesh Adlakha: In gloptipoly, how is the absence of a user defined ball constraint handled?
- Victor Magron: For symmetries: https://arxiv.org/abs/1103.0486
- Jan Ramon: is thee work on symmetric polynomials (i.e. replacing x with y and y with x gives the same polynomial), which may strongly reduce the space of polynomials to consider?

- Victor Magron: @Jan: https://arxiv.org/abs/1103.0486 there is a special section on this
- Antonio Bellon: Other than Lasserre hierarchy which are other common approaches to PolyOpt?
- Harold Nieuwboer: Is there a general estimate for the necessary radius bound R, or just for specific problems?
- Seth Chaiken: What are some applications of optimization on symmetric polynomials?
- Victor Magron: For sparsity: https://arxiv.org/abs/1607.01151
- Yang Qi to everyone:
- Victor Magron: More on sparsity: http://www.optimization-online.org/DB_FILE/2006/04/1367.pdf https://arxiv.org/pdf/1912.08899.pdf https://arxiv.org/abs/2003.03210 https://arxiv.org/abs/2005.02828