**CSE4301 / 5290 PROJECT CONCEPTS** **FALL 2017**

*UG: individual GRAD: ~2-persons’ group*

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| ***GRAD*** | ***Bracketed [topics] are extensions that may lead to publications***  ***Project deadlines, First: Oct 5 (UG), Oct 12 (Grad)***  ***Second: Oct 26***  ***Third: Nov 28*** |
| **1.** Cluster North Atlantic Hurricane paths over the years. Use star-calculus for approximate path representation.  Future: predict eye-wall replacement vector, from surroundings:  Damweber, Bridget A.  Syed, Muntaser M. | 1. Download Tracks Data. How many tracks did you get? (Preferably visualize them, but do not spend too much time on that). *DONE*  *--------------------------------- deliverable VISUALIZE DATA*  2. Approximately represent tracks using possibly Star-calculus (what is the best angular resolution?).  3. Decide on distance metrics (may be different types, e.g., based on star-calc, polar coordinate, lat-long, or hybrid!)  ***My notes from presentation-1 (I would like to see addressed in future report/presentation):***  ***You need to show if Star-calculus is really needed – comparison should be against using only angle difference; What if you use Euclidian/non-Euclidian distance only?; Check with me on your understanding of longest-common-subsequence and the dynamic programming algorithm; Your output is not only one cluster from each version of your algorithm, but many – study/observe/show them; Conclude by guessing on some meaning of the patterns you see for different clusters***  ---------------------------------- *deliverable SMALL REPORT*  4. Decide on clustering algorithm to use.  5. Cluster tracks and check against years, and other conditions you can have access to.  6. Write a short paper – we may send it to Jim Kossin or to a conference/journal.  [7. Data of Eyewall Replacement Cycles’ vectors:  Similar clustering will be a new result]  *References:*  *cs.fit.edu/~dmitra/ArtInt/Fall2017/* *Eyewall-Kossin2016.pdf*  */HurricaneAmbience-Kossin-nature2017.pdf*  [*http://www.ssec.wisc.edu/~kossin/pubs.html*](http://www.ssec.wisc.edu/~kossin/pubs.html)  *----------- deliverable* |
| **2.** Use Deep learning to cluster MNIST handwritten digits. May use RNN.  Hasanain, Ahmad Z. | 1. Which deep learning algorithm will you use for clustering? Submit a short report.  (Check this one: *cs.fit.edu/~dmitra/ArtInt/Fall2017/* *UnsupervisedCNN-Ng-Icml2009.pdf, for Troy-Milton: TsnePaper-MaatenJMLR2008.pdf* )  -------------------------------- *deliverable SMALL REPORT*  2. Where will you obtain its Code or will you write it?  3. Produce clusters of digits (MNIST database) without knowing which digit is what. Submit a short report.  ***My notes from presentation-1 (I would like to see addressed in future report/presentation):***  ***Very good presentation; Your first slide is not clear to me – bits/pixel or bits/whole image that gets compressed?***  --------------------------- *deliverable WORKING CODE*  4. Check clusters accuracy now against known digits (find proper metric for this purpose).  5. Write a Technical Report.  -------------------------- *deliverable FINAL REPORT* |
| **2’.** Use Deep learning to cluster MNIST handwritten digits. May use RNN.  Stafford, Milton C.  Toggweiler, Troy D. | 1. Which deep learning algorithm will you use for clustering? Submit a short report.  (Check this one: *cs.fit.edu/~dmitra/ArtInt/Fall2017/* *UnsupervisedCNN-Ng-Icml2009.pdf, for Troy-Milton: TsnePaper-MaatenJMLR2008.pdf* )  -------------------------------- *deliverable SMALL REPORT*  2. Where will you obtain its Code or will you write it?  3. Produce clusters of digits (MNIST database) without knowing which digit is what. Submit a short report.  ***My notes from presentation-1 (I would like to see addressed in future report/presentation):***  ***What is PCM? What are the features you used in learning and how do they get extracted? How do you evaluate clusters?***  --------------------------- *deliverable WORKING CODE*  4. Check clusters accuracy now against known digits (find proper metric for this purpose).  5. Write a Technical Report.  *My notes from presentation-1 (I would like to see addressed in future report/presentation):*  -------------------------- *deliverable FINAL REPORT* |
| **3.** Develop and use 3D-star calculus to approximately represent organs in human body:  Chang, Haoran | Map Organs: Heart, Liver, Kidneys  *cs.fit.edu/~dmitra/ArtInt/Fall2017/* Flairs1302Dmitra.pdf , *TryingMitraAiMath15.doc*  1. Decide 3D-star calculus relative directions. Axes? Angle zones?  --------------------------------- *deliverable SMALL REPORT*  2. Atlas centroids of those organs and Star-calc representation between them  => Obtain centroids of those three 4 organs/regions on the CT data of a patient  ***My notes from presentation-1 (I would like to see addressed in future report/presentation):***  ***Good presentation; Presenting from .doc may not be ok next time; Discussion following eq. 8 is not clear – SVD may be used to find pseudo-inverse – are you finding that of matrix m or just its SVD? I want to see your code. Must show your transformed points on CT, just errors are not enough.***  -------------------------------- *deliverable SMALL REPORT*  3. Transform atlas representation to CT representation and verify accuracy  [4. Segmentation of organs on CT data:  Conference deadline: next year]  ----------------------- *deliverable* *FINAL REPORT* |
| **4.** Implement Temporal constraint network (TCN):  Rothman, Aaron J. | 1. Discuss relevant parts of TCN paper with me:  *cs.fit.edu/~dmitra/ArtInt/Fall2017/tcn-meiri-dechter-aij1991.pdf*  *[first 12 pages, possibly excluding Thm 3.3, will do for now]*  2. Preprocessing code to convert a Simple TCN to weighted directed graph  ---------------------------------- *deliverable WORKING CODE*  3. Floyd-Warshall code for simple TCN to create minimal network  ***My notes from presentation-1 (I would like to see addressed in future report/presentation):***  ***Need to improve presentation skill! You may put screen shots on report/slides. Draw graphs to explain problem and approaches, only text is not enough in explaining this project. Complete: (1) Unsatisfiability detection; (2) Shortest path recovery -> translating back to STP; (3) unsatisfiability -> negative cycle in distance graph -> detect from FW output -> translate back to STP; (4) Meet me offline.***  ----------------------------------- *deliverable WORKING CODE with SAMPLE I/O SCREEN SHOT*  *DEMO+CODE-REVIEW ON MONDAY 12/4/17 @TIME-PLACE?*  [4. Explanation generation for inconsistency: possibility of a paper, early November]  5. Backtracking or Forward Checking on full TCN and creating minimal network  [6. Map onto Timed Automata: Journal paper]  --------------------- *deliverable FINAL REPORT* |
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| ***UNDERGRAD*** | ***Deadlines:*** |
| Implement A\* search algorithm and its variations (at least 2 variations, you are free to decide them on your own but my suggestions: IDA\* and SMA\*).  Suggested data: Run on the US major freeways network (or any other problem of your choice). Be aware of memory-complexity!  **Experiment on these different variations/improvements of informed search algorithms for time and** **memory consumption (needs more thoughts on experiment design than you think now!).** | **Oct 5**: 1-2 pg project plan, hardcopy due in class.[30%]  *Answer in the report*:  Which 3 algorithms will you use?  Which language will you use to code?  If you decide to use some code, what is the source of that code, and how will you modify that code for your project (must)?  Which data will you work on?  Briefly describe the design of your experiments, what will you measure, how many times you will run the code, etc.?  ------------------ *deliverable*  Other deadlines will be on:  Code-submission and report on algorithms.  ------------------ *deliverable* Due **Oct 26** [30%]  Final report on **experimental** results Due **Nov 28** [40%] |
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