FP7-PEOPLE-2009-IRSES:
Project ID 246647

Optimization and its **A**pplications
in **L**earning and **I**ndustry
(OptALI)

IRSES

Ongoing Deliverable D1.2

Description of Research Seminar: Investigating Efficient Algorithms for Maximum Convex Sum Problem

Start date of the Workpackage:	December 2010
Duration:	48 months
Due date of deliverable:	November 2014
Actual submission date:	January 2012
Participants:	UGOE UNIKL DTU UOA UC
Author of deliverable:	M. Thaher (mohammed.thaher@pg.canterbury.ac.nz)

Research Seminar

offered by Mohammed Thaher (UC)

in August 2012, September 2012, and October 2012

UGOE,UNIKL,DTU in Germany and Denmark

Subject: Maximum Convex Sum Problem and its applications.

Problem: Historically, the problem of finding the maximum sums was initially introduced by J. Bentley. This problem has two types: one-dimensional (1D) and two-dimensional (2D) versions. The 1D version is called the maximum subsequence problem, and the 2D version is named the *Maximum Subarray Problem (MSP)*. The MSP involves a selection of segments of consecutive array elements that has the largest possible sum compared with all other segments in presented data using the *rectangular shape*. The MSP can also be a method that gives an accurate trend with respect to associated parameters in vast data. Since the emergence of MSP, subsequent algorithms tackling the problem have been developed to improve the time complexity for 1D and 2D. In 2010, MSP took a new turn by using the *convex shape*; the new problem is called the *Maximum Convex Sum Problem (MCSP)*. This new approach returns more precise results by increasing the gain; this is compared to that of MSP outcomes using the same time complexity. Most recently, we generalised the problem to that of the K-MCSP to find the *K Maximum Convex sums*, which covers the disjoint case and the *overlapping case*. These algorithms were derived to find the first, second, third, and up to the Kth Maximum Sums. On the one hand, the disjoint case algorithm maximised the sum while achieving the same complexity for the existing algorithm of O(kn3). On the other hand, the overlapping case is achieved in O(kn3) time complexity, which is improved later to O(n3+kn2).Furthermore, two examples from computer vision to data mining were covered.

Main Results: We started the K maximum convex sums for the two cases *disjoint* and *overlapping* case. Additionally, we developed techniques to speed up the algorithms.

Participants: Early stage and experienced researchers and students from UC, UGOE, UGOE, UNIKL, DTU, UOA.

Publication: Thaher, M. and Takaoka T., Improved algorithms for the K overlapping maixium convex sum problem, ICCS, 754- 762 (2012)