IIT Mandi
Proposal for a New Course

Course No.: EE-511
Course Name: Computer Vision
Credits (L-T-P-C): 3-0-2-4
Prerequisites: Linear algebra, Probability and Statistics
Intended for: UG / MS / M. Tech. / PhD
Distribution: Elective: B. Tech III/IV year / MS / M. Tech. / PhD
Semester: Odd / Even

Preamble:
Computer vision is an important applied research area encompassing aspects from geometry, machine learning, probabilistic models, optimization etc. The course consists of various important aspects of computer vision namely geometry, motion, image features, and low-level and high-level image labeling. The course is designed such that some fundamental frameworks as well as some contemporary methods are covered. The course also has a lab component, which includes programming assignments related to many of the topics mentioned below.

Course modules:

Unit 1: Essential mathematical tools: Least squares, RANSAC, Eigen-analysis, PCA, SVD, clustering, gradient-based optimization methods   (4 hours)

Unit 2: Geometry, Camera models, Epipolar geometry, Stratified reconstruction, Applications: large scale reconstruction, single-view metrology   (8 hours)

Unit 3: Probabilistic graphical models: MRF, CRF, Combinatorial optimization methods (5 hours)

Unit 4: Stereo disparity estimation, Optical flow (Lucas Kanade and Horn Schunk approaches, contemporary energy minimization methods)   (5 hours)

Unit 5: Features detection and tracking: Harris corner detector, KL tracking, SIFT, Overview of other contemporary descriptors.   (5 hours)

Unit 6: Segmentation: Low-level segmentation, energy minimization and clustering based methods, semantic segmentation   (5 hours)

Unit 7: High level vision: CNN overview, single image depth estimation, Flow-net, 3D scene understanding and segmentation. (6 hours)

Unit 8: Synthesis: GAN overview, 3D shape synthesis, integrating viewpoint and texture, semantic image synthesis (4 hours)

Text books:
D. Forsyth and J. Ponce, Computer vision – A modern approach, Second edition, Pearson, 2012.

References:
1. R. Hartley and A. Zisserman, Multiple view geometry in computer vision, Second edition, Cambridge univ. press, 2003
2. S. Prince, Computer vision – Models, learning and inference, Cambridge univ. press, 2012.
3. C. Bishop, Pattern Recognition and Machine learning, Springer, 2006.

Similarity Content Declaration with Existing Courses: NIL
Justification for new course proposal if cumulative similarity content is > 30%: NA

Proposed by: Dr. Renu Rameshan, Arnav Bhavsar
School: SCEE

Signature: _____   Date:

Recommended / Not Recommended, with Comments:

_____   Date:
Chairman, CPC

Approved / Not Approved

_____   Date:
Chairman, Senate