

CISE Ph.D. Qualifying Exam Syllabus
Intelligent Systems Area
Artificial Neural Networks and Computer Vision

Artificial Neural Network Topics

The exam will cover mathematical and algorithmic aspects of the field of Artificial Neural Networks. It will not include hardware implementations.

The specific list of topics that should be studied for the exam is:

- (1) Single Layer Perceptrons
- (2) Multi-layer Perceptrons
- (3) Associative Memories
- (4) Radial Basis Function Networks
- (5) Support Vector Machines
- (6) Principal Components Analysis
- (7) Independent Components Analysis
- (8) Mixture Models

Artificial Neural Network Relevant Courses

CAP 6615

Artificial Neural Network Reading List

- Simon Haykin, Neural Networks: A Comprehensive Foundation (2nd Edition), Prentice-Hall, 1999.
- Christopher M. Bishop, Neural Networks for Pattern Recognition, Oxford University Press, 1995
- Kishan Mehrotra, C K. Mohan and Sanjay Ranka, Elements of Artificial Neural Networks, MIT Press, 1996.

Computer Vision Texts and Other Material:

- *Recommended Text: Computer Vision - A modern approach*, by D. Forsyth and J. Ponce, Prentice Hall

and

- *Robot Vision*, by B. K. P. Horn, McGraw-Hill.
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Computer Vision Relevant Courses

CAP 5416

Computer Vision References

- *Introductory Techniques for 3D Computer Vision*, by E. Trucco and A. Verri, Publisher: Prentice Hall.

Computer Vision Syllabus

Image Formation Models

- Monocular imaging system
- Orthographic & Perspective Projection
- Camera model and Camera calibration
- Binocular imaging systems

Image Processing and Feature Extraction

- Image representations (continuous and discrete)
- Edge detection

Motion Estimation

- Regularization theory
- Optical computation
- Stereo Vision
- Motion estimation
- Structure from motion

Shape Representation and Segmentation

- Deformable curves and surfaces
- Snakes and active contours
- Level set representations
- Fourier and wavelet descriptors
- Medial representations
- Multiresolution analysis

Object recognition

- Hough transforms and other simple object recognition methods
- Shape correspondence and shape matching
- Principal component analysis
- Shape priors for recognition