16-720 Computer Vision Fall 2026

Last updated August 18, 2026

TR | **3:30–4:50 PM** | **TEP 1403** | **Lecturer:** Kris Kitani | **TAs:** Ce Zhang, Wenli Xiao, Vihaan Misra, Aviral Chharia, Manan Shah

COURSE OVERVIEW

This course introduces the fundamental principles and algorithms of computer vision, focusing on how machines interpret, recognize, and reconstruct the visual world from images. Topics include filtering, feature detection and matching, image representations, classical and deep visual recognition, camera geometry, multi-view reconstruction, stereo vision, optical flow, and image alignment. Programming assignments use Python, NumPy, OpenCV, and PyTorch.

Prerequisites:
Linear Algebra, Multivariate Calculus, Probability Theory, Python Programming, and prior exposure to Machine Learning.

ASSESSMENT

Programming Assignment 1: Image Features	25%
Programming Assignment 2: Recognition	25%
Programming Assignment 3: Geometry and Motion	25%
Checkpoint 1	10%
Checkpoint 2	10%
Checkpoint 3	10%
Total:	**105%**

Grading:
A+ $\geq$ 100%, A 90–99%, B 80–89%, C 70–79%, D 60–69%, R $<$ 60%.

LEARNING OUTCOMES

Students should be able to:

1. Apply filtering, frequency-domain methods, and image pyramids to analyze and transform images.
2. Detect, describe, and match local image features, and evaluate their robustness to visual changes.
3. Build and evaluate visual recognition systems using classical classifiers, convolutional networks, and vision transformers.
4. Explain the core ideas behind modern object-detection and generative models, including DETR, GANs, and VAEs.
5. Estimate image and camera geometry for alignment, pose estimation, triangulation, and multi-view reconstruction.
6. Analyze stereo correspondence and visual motion using optical flow and image-alignment methods.
7. Implement, test, and communicate computer-vision systems using Python, NumPy, OpenCV, and PyTorch.

LATE DAYS AND COLLABORATION

Students receive five late days for the semester and may use at most two on any one programming assignment. No credit is given after all late days are exhausted. Regrade requests must be submitted within two weeks. Additional flexibility may be granted for circumstances outside a student's control, but not for planned activities such as conference deadlines or vacation travel. The three in-class checkpoints emphasize conceptual understanding and steady engagement. There is no final exam.

High-level discussion is encouraged, but submitted code and writing must be your own. Acknowledge collaborators, outside resources, and generative AI assistance. AI may support learning and debugging, but may not replace your understanding or authorship.

CLASS SCHEDULE

Date	No.	Topic	Assignments / Notes
Aug 25	L1	Introductions, Policies, Grading, Applications of Computer Vision	
Aug 27	L2	Filtering and Image Pyramids	
Sep 1	L3	Fourier Domain	
Sep 3	L4	Image Boundaries and Gradient Filters	
Sep 8	L5	Feature Detection	**HW1 Released: Image Features**
Sep 10	L6	Feature Descriptors	
Sep 15	L7	Image Representations: GIST, Bag of Visual Words	
Sep 17	–	**Checkpoint 1**, lecture continuation	
Sep 22	L8	Classification Methods: K-NN, Naive Bayes, SVM	
Sep 24	L9	Neural Networks: Perceptron, Gradient Descent, SGD	
Sep 29	L10	Initialization, Learning Rates, and Optimization Algorithms	**HW1 Due** **HW2 Released: Recognition**
Oct 1	L11	CNN Classification and Detection	
Oct 6	L12	Vision Transformer	
Oct 8	L13	DETR, GAN, VAE	
Oct 13	–	**NO CLASS — Fall Break**	
Oct 15	–	**NO CLASS — Fall Break**	
Oct 20	L14	2D Transformations: Euclidean, Similarity, Affine, Projective	
Oct 22	–	**Checkpoint 2**, lecture continuation	
Oct 27	L15	Homography Estimation	**HW2 Due** **HW3 Released: Geometry and Motion**
Oct 29	L16	Single-View Geometry	
Nov 3	–	**NO CLASS — Democracy Day**	
Nov 5	LX	Special Topic	
Nov 10	L17	Camera Models, Pose Estimation, and Triangulation	
Nov 12	L18	Epipolar Geometry	
Nov 17	L19	Structure from Motion	
Nov 19	–	**Checkpoint 3**, lecture continuation	
Nov 24	L20	Stereo, Optical Flow	**HW3 Due**
Nov 26	–	**NO CLASS — Thanksgiving**	
Dec 1	L21	Optical Flow, Image Alignment	
Dec 3	LX	Special Topic	