List of Projects

1. **Use any voice activity detection (VAD) algorithm to detect changes in energy, spectral & cepstral distance and categorize the emotion among (a) happy (b) sad (c) depression (d) fear (e) angry.**

   For VAD- do end point detection using spectral energy in frequency domain than set a frequency range and remove the spectral energy less than 0. Sum for each frame and set a threshold, create a length filter to connect and remove and set buffer.

   (PARK, J. S., YOON, J. S., SEO, Y. H., & JANG, G. J. (2017). SPECTRAL ENERGY BASED VOICE ACTIVITY DETECTION FOR REAL-TIME VOICE INTERFACE. *Journal of Theoretical & Applied Information Technology*, *95*(17).
   (Cen, L., Wu, F., Yu, Z. L., & Hu, F. (2016).A real-time speech emotion recognition system and its application in online learning.In *Emotions, technology, design, and learning* (pp. 27-46).Academic Press.)

   Name of the student: Kshitij Chauhan(2K17/CO/159)

2. **Implement orthogonal matching pursuit (OMP) algorithm for feature extraction in music classification for mood recognition**.

   OMP is iterative algorithm that finds sub optimal solution i.e. in each iteration one non-zero location of sparse solution is found and residual gets updated do this 'n' times then calculate the approximation.

   (Mo, S., &Niu, J. (2017). A Novel Method based on OMPGW Method for Feature Extraction in Automatic Music Mood Classification. IEEE Transactions on Affective Computing.)

   Name of the student :Devashish(2K17/SE/03)

3. **Apply Gabor wavelet transform to extract key features of facial expression from an image or video sequence.**

   Gabor has both multi resolution and multi orientation properties for measuring local spatial frequencies. Gabor wavelet provide a localized frequency analysis, mean and standard deviation of the transform represents the texture information.

   (B. V. Kumar and B. S. Shreyas, "Face Recognition Using Gabor Wavelets," 2006 Fortieth Asilomar Conference on Signals, Systems and Computers, Pacific Grove, CA, 2006, pp. 593-597)

   Name of the student: Laurent Denis(2K17/CO/190)

4. **From extracted ROI (region of interest) construct and train a SVM (support vector machine) learning algorithm for emotion recognition.**

   SVM can work as linear classifier and by using the kernel concept SVM can extend to non-linear. The image is broken into several sub-images and numbers of points are chosen. Preprocess the sub images using masking, light correction, histogram equalization. If sub data sets yields better support they are decided as final support vectors.

   (Chen, C., Dantcheva, A., & Ross, A. (2013, June). Automatic facial makeup detection with application in face recognition. In 2013 international conference on biometrics (ICB) (pp. 1-8). IEEE.)
   (Hsieh, C. C., Hsih, M. H., Jiang, M. K., Cheng, Y. M., & Liang, E. H. (2016).Effective semantic features for facial expressions recognition using SVM. Multimedia Tools and Applications, 75(11), 6663-6682.)

   Name of the student: Rishabh Bansal(2K17/BT/018)

5. **Use template matching methodology such as Naïve template matching (NTM), Image Correlation Matching (ICM), Pattern Correlation Image (PCI), Grayscale Based Matching (GBM), Edge Based Matching (EBM) and use them as a classifier to classify various emotions from an image or video sequence.**

   Load data, apply feature extraction method and apply the template matching algorithm as classifier if the regression value found to be greater than the threshold value then the emotion lies in arousal category (i.e. Anger, excitement, joy) and if not then in non-arousal category (i.e. anxiety, fear, sadness).

   (Perveen, N., Kumar, D., & Bhardwaj, I. (2013). An overview on template matching methodologies and its applications. International Journal of Research in Computer and Communication Technology, 2(10), 988-995.)
   (Swaroop, P., & Sharma, N. (2016).An overview of various template matching methodologies in image processing. International Journal of Computer Applications, 153(10), 8-14.)

   Name of the student: Ashish Thakur(2K17/CE/12)

6. **Use color histogram method to obtain the similarities between the key frames of a given image with test images and relate this result with clustering based strategy (K-means).**

Set the number of bins into which the red, green and blue channels are to be divided to separate the three RGB channels, this allows to find the key frames and variations in the features. Take the average value of R,G and B image it gives the features of the image.

(This technique is used for detection of disease in the leaves of plant by extracting its feature using color histogram method. The idea here is to use the same technique for feature extraction in micro expression recognition.)

Name of the student: Sunil (2K17/CO/350)

7. Multimodal Depression detection using affective sensing technology by fusion analysis of paralinguistic, head pose and eye gaze behaviors.

This consists of verbal and non-verbal data. For verbal- extracting features from the extensive manual labelling, and extracting speech rate features from subjects' segments. For non verbal- movement of iris and eye lids are tracked along with head movement. For more accuracy cost and gamma parameters are to be optimized using LibSVM as a classifier. Finally the fusion of all the verbal and non-verbal parameters is to be done.

(Alghowinem, S., Goecke, R., Wagner, M., Epps, J., Hyett, M., Parker, G., &Breakspear, M. (2016). Multimodal depression detection: fusion analysis of paralinguistic, head pose and eye gaze behaviors. IEEE Transactions on Affective Computing, 9(4), 478-490.)

Name of the student: Taksh Kamlesh (2K17/CO/358)

8. Facial Expression Recognition in Video with Multiple Feature Fusion.

HOG-TOP (histogram of oriented gradient from three orthogonal planes) used to extract features from video sequence to characterize facial changes. Get the number of frames 'N' of same width 'W' and height 'H', get the local patch in three planes, compute the gradient and gradient orientation, get a histogram for each plane and normalize it. To extract feature of acoustic modality obtain the time series of multiple paralinguistic descriptors and then using pooling operations on each time series to extract feature vectors these acoustic features include energy/spectral Low Level Descriptors (LLD) and voice related LLD. Geometric warp features are extracted from warp transform of facial landmarks.

(Chen, J., Chen, Z., Chi, Z., & Fu, H. (2016). Facial expression recognition in video with multiple feature fusion. IEEE Transactions on Affective Computing, 9(1), 38-50.

Name of the student :Shriniwas Ray(2K17/EE/203)

9. **Temporal Segmentation and Labeling for Audio-Visual Emotion Recognition**

Calculate emotion estimates from the upper and lower face regions using the pitch of speech and phonetic content for each of the two regions, respectively, to control for speech-related variability. We then segment and estimate emotion content using samples with similar dynamic characteristics. The utterance-level emotion estimates from speech are calculated using Support Vector Machines. We combine utterance-level emotion estimates from the upper face, lower face, and speech modalities.

(Kim, Y., & Provost, E. M. (2017). ISLA: Temporal segmentation and labeling for audio-visual emotion recognition. IEEE Transactions on Affective Computing, 10(2), 196-208.)

Name of the student :Sanmveg(2K17/EP/070)

10. **To extract features of an image using Quaternion-Based Multiscale Analysis method.**

The method called multiscale quaternion Weber local descriptor histogram (MQWLDH) for feature extraction is used to model spatial information based on the corresponding spectral features. This method first transforms spectral data into an orthogonal space using principal component analysis, and extracts the first three principal components (PCs) based on the maximum variance theory. Then, construct the MQWLDH to extract spatial features based on those first three PCs. This method uses the algebraic structure of quaternions to unify the process of processing the first three PCs, which reduces the computational cost and the dimensionality of the extracted spatial feature vector. To capture more intrinsic spatial information contained in homogeneous regions of different sizes and shapes, multiscale feature histograms are constructed. Finally, a feature fusion framework is proposed to fuse spectral and spatial features so that spectral information can be fully utilized.

("Quaternion-Based Multiscale Analysis for Feature Extraction of Hyperspectral Images", IEEE Transactions on Signal Processing, Year: 2019 , Volume: 67, Issue: 6.)

Name of the student: Prashant Kumar(2K17/ME/169)

11. **To extract features of an image using Deep hashing neural network.**

A novel deep model, named deep hashing neural network (DHNN) is proposed to learn similarity-preserving deep features (SPDFs) for HSI classification. First, a well-pretrained network is introduced to simultaneously extract features of a pair of input samples. Second, a novel hashing layer is inserted after the last fully connected layer to transfer the real-value features into binary features, which can significantly speed up the computation for feature

distance. Then, a loss function is elaborately designed to minimize the feature distance of similar pairs and maximize the feature distance of dissimilar pairs in Hamming space.

("Deep Hashing Neural Networks for Hyperspectral Image Feature Extraction", IEEE GEOSCIENCE AND REMOTE SENSING LETTERS, VOL. 16, NO. 9, SEPTEMBER 2019)

Name of the student:Shobhit Jain (2K17/ME/219)

12. To implement cascaded static and dynamic local features extraction method for extracting features of an image.

The face sketch has some degrees of shape exaggeration that make some parts of the face geometrically misaligned. The effect of these influences are addressed by a cascaded static and dynamic local feature extraction method so that the constructed feature vectors are built based on the correct patches. In this method, the feature vectors from the local static extraction on a sketch and photo are matched using the nearest neighbours. Then, some n most similar photos are shortlisted based on the nearest neighbours. These photos are eventually re-matched using feature vectors from the local dynamic extraction method.

("Cascaded Static and Dynamic Local Feature Extractions for Face Sketch to Photo Matching", IEEE Access, Year: 2019, Volume: 7, Journal Article.)

Name of the student:Vaibhav Soni (2K17/ME/115)

13. To implement the DEX (Deep Expectation) Network used for age estimation.

The estimation of apparent age in still face images with deep learning uses the VGG-16 architecture. The age regression problem is posed as a deep classification problem followed by a softmax expected value refinement and show improvements over direct regression training of CNNs. Deep EXpectation (DEX) of apparent age, first detects the face in the test image and then extracts the CNN predictions from an ensemble of 20 networks on the cropped face. The CNNs of DEX were finetuned on the crawled images and then on the provided images with apparent age annotations.

("Deep EXpectation of real and apparent age from a single image without facial landmarks", 2018 International Journal of Computer Vision, 126:144-157)

Name of the student: Ajay Dabas(2K17/ME/12)

14. **To extract leaf features for plant classification using deep neural network.**

Plant identification systems developed by computer vision researchers have helped botanists to recognize and identify unknown plant species more rapidly. In this project, the useful leaf features are learned directly from the raw representations of input data using Convolutional Neural Networks (CNN), and gain intuition of the chosen features based on a Deconvolutional Network (DN) approach.

(" How deep learning extracts and learns leaf features for plant classification", Pattern Recognition (Elsevier), 2017.)

Name of the student: Shrey Tanwar(2K17/SE/11)

15. **To implement the distributed parallel dimensionality reduction algorithm based on PCA.**

In this project, DP-PCA is used to reduce the tedious calculation process of PCA algorithm and time consuming of processing massive stream data. This method includes three parts of improvement. Firstly, the original dataset is pre-processed by the mean method. Secondly, the solution process of correlation coefficient matrix is improved. Thirdly, it designs a distributed parallel dimensionality reduction scheme for the algorithm.

("Research on Distributed Parallel Dimensionality Reduction Algorithm Based on PCA Algorithm", 2019 IEEE 3rd Information Technology, Networking, Electronic and Automation Control Conference (ITNEC 2019)).

Name of the student: Ashish Balwda(2K17/CO/079)

16. **To implement super pixel based Dimension Reduction technique for image data.**

In this project, the super-pixel based linear discriminant analysis (SP-LDA) dimension reduction method is to be implemented. Firstly, super-pixel segmentation is used to extract the super-pixel map which can adaptively explore the neighbourhood structure information. Then this method is further extended by combining the extracted spatial and spectral features which exploits complementary and consistent information from both dimensions.

("Superpixel Based Dimension Reduction for Hyperspectral Imagery", IGARSS 2018 - 2018 IEEE International Geoscience and Remote Sensing Symposium)

Name of the student: Anishar Ghimire(2K17/CO/085)

17. **To implement the Nonparametric Dimension Reduction via Maximizing Pairwise Separation Probability method.**

In this project, the novel nonparametric supervised linear dimension reduction (SLDR) algorithm extracts the features by maximizing the pairwise separation probability. The separation probability, as a new class separability measure, describes the generalization accuracy when the obtained features are used to train a linear classifier. Obtaining high-quality features, the this method avoids the overlaps between classes that are close to each other in the input space and improves the subsequent classification performance.

("Nonparametric Dimension Reduction via Maximizing Pairwise Separation Probability", IEEE TRANSACTIONS ON NEURAL NETWORKS AND LEARNING SYSTEMS, VOL. 30, NO. 10, OCTOBER 2019).

Name of the student: Anmol Goyal(2K17/CO/066)

18. **To understand and implement Hinge-loss Markov Random Fields technique for activity detection.**

In this project, we propose hinge-loss Markov random fields (HL-MRFs), a powerful class of continuous-valued graphical models, for high-level computer vision tasks. HL-MRFs are characterized by log-concave density functions, and are able to perform efficient, exact inference.

Their template hinge-loss potential functions naturally encode soft-valued logical rules. Using the declarative modelling language probabilistic soft logic, one can easily define HL-MRFs via familiar constructs from first-order logic. We apply HL-MRFs to the task of activity detection, using principles of collective classification. Our model is simple, intuitive and interpretable. We evaluate our model on two datasets and show that it achieves significant lift over the low-level detectors.

("Collective Activity Detection Using Hinge-loss Markov Random Fields", 2013 IEEE Conference on Computer Vision and Pattern Recognition Workshops.)

Name of the student:**Pranit Tondon (2K17/CO/231)**

19. **To implement max sub graph search technique for activity detection.**

In this project, we propose an efficient approach that unifies activity categorization with space-time localization. The main idea is to pose activity detection as a maximum-weight connected subgraph problem over a learned space-time graph constructed on the test sequence.

We show this permits an efficient branch and cut solution for the best-scoring and possibly non-cubically shaped portion of the video for a given activity classifier. The upshot is a fast method that can evaluate a broader space of candidates than was previously practical, which we find often

leads to more accurate detection. We demonstrate the proposed algorithm on three datasets, and show its speed and accuracy advantages over multiple existing search strategies.

("Efficient activity detection with max-sub graph search", 2012 IEEE Conference on Computer Vision and Pattern Recognition.)

Name of the student: Rahul Yadav (2K17/CO/253)

20. To understand and implement the velocity histories of tracked key points technique for activity recognition.

In this project, we present an activity recognition feature inspired by human psychophysical performance. This feature is based on the velocity history of tracked keypoints. We present a generative mixture model for video sequences using this feature, and show that it performs comparably to local spatio-temporal features on the KTH activity recognition dataset.

In addition, we contribute a new activity recognition dataset, focusing on activities of daily living, with high resolution video sequences of complex actions. We demonstrate the superiority of our velocity history feature on high resolution video sequences of complicated activities. Further, we show how the velocity history feature can be extended, both with a more sophisticated latent velocity model, and by combining the velocity history feature with other useful information, like appearance, position, and high level semantic information. Our approach performs comparably to established and state of the art methods on the KTH dataset, and significantly outperforms all other methods on our challenging new dataset.

("Activity recognition using the velocity histories of tracked key points, 2009 IEEE 12th International Conference on Computer Vision.)

Name of the student: Shikhar (2K17/ME/215)

21. To understand and implement Dynamic Time Warping technique of activity monitoring for the elderly and disabled people.

In this project, we present a new system that tracks human movements and behaviours for rehabilitative purposes. We applied Dynamic Time Warping (DTW) to recognize human activities of daily living.

Ten different movements, standing, sitting, lying on the left side, lying on the right side, lying supine, lying prone, walking, running, stand-to-sit and sit-to-stand are considered and were kept to reference databases signals.

("Activity monitoring system using Dynamic Time Warping for the elderly and disabled people", 2009 2nd International Conference on Computer, Control and Communication)

Name of the student: Shaurya Singh (2K17/ME/214)

22. To Understand and implement stochastic parsing for visual activity recognition.

In this project, we present a probabilistic syntactic approach to the detection and recognition of temporally extended activities and interactions between multiple agents.

The fundamental idea is to divide the recognition problem into two levels. The lower level detections are performed using standard independent probabilistic event detectors to propose candidate detections of low-level features. The outputs of these detectors provide the input stream for a stochastic context-free grammar parsing mechanism. The grammar and parser provide longer range temporal constraints, disambiguate uncertain low-level detections, and allow the inclusion of a priori knowledge about the structure of temporal events in a given domain. To achieve such a system we: 1) provide techniques for generating a discrete symbol stream from continuous low-level detectors; 2) extend stochastic context-free parsing to handle uncertainty in the input symbol stream; 3) augment a run-time parsing algorithm to enforce inter symbol constraints such as requiring temporal consistency between primitives; and 4) extend the consistency filtering to maintain consistent multi object interactions.

("Recognition of Visual Activities and Interactions by Stochastic Parsing, IEEE transactions on pattern analysis and machine intelligence, vol. 22, no. 8, august 2000.")

Name of the student: Aries Mittal (2K17/ME/60)

23. Human activity recognition based on multiple motion trajectories.

In this project, we propose a method for activity recognition based on multiple motion trajectories. Motion trajectories generated from body parts (hand, feet, and joints) are used as features. We not only recognize each activity but also temporally locate the start and end point of its duration.

Input sequences are divided into separate temporal segments based on the number of detected trajectories. Segments with same number of trajectories are temporally segmented using the HMM model for each movement (activity).

("Activity Recognition Based on Multiple Motion Trajectories", Proceedings of the 17th International Conference on Pattern Recognition, ICPR 2004.)

Name of the student: Jay Saraswat (2K17/ME/112)

24. Object tracking based on granular computing theory.

This project is based on the object tracking. The granular computing theory is used to track the object efficiently. The advent of Big Data has seen both the sources and volumes of data increase

rapidly. A multi-source information system can be used to represent information drawn from multiple sources. However, some of these sources are of less importance than others, and some are essentially worthless. Selecting the most valuable sources and efficiently fusing information are therefore core issues in the field of data science. To investigate this matter, Granular computing theory is used.

("A novel approach to information fusion in multi-source datasets: A granular computing viewpoint", Information Sciences (Elsevier) Volume 378, 1 February 2017, Pages 410-423)

Name of the student: Arth Singh (2K17/CO/075)

25. Second order efficient inference based anomaly detection in a video.

In this project we will develop a new methodology to find out the anomaly in the video. This could be applicable for the security and surveillance. General strategies for constructing second order efficient robust distances from suitable properties of the residual adjustment functions (RAF) are used. Based on those properties families of estimators are constructed using the truncated polynomial, negative exponential and sigmoidal functions as RAFs and their efficiency and robustness properties are investigated. The estimators have full asymptotic efficiency, and are automatically second order efficient. Many of the proposed estimators are competitive or better than the minimum Hellinger distance estimator (MHDE) and minimum negative exponential disparity estimator (MNEDE) under the combined goals of asymptotic efficiency with strong robustness properties. Hence the proposed families give the user the flexibility to choose from a large class of robust second order efficient estimators based upon specific needs.

("On second order efficient robust inference", Computational Statistics & Data Analysis (Elsevier), Volume 88, August 2015, Pages 187-207.)

Name of the student: Ankit Nirwal(2K17/CO/61)

26. Volterra Series based feature descriptor.

Human gait recognition has been used as one of the prominent biometric property. This project recognizes the gait using Volterra series based feature descriptor. Volterra analysis and its variants have long been prominent among methods for modeling multi-input non-linear systems. The product of Volterra analysis, the Volterra kernels, are particularly suited to quantifying intra- and inter-input interactions. They are also readily interpretable, which means that they can be related directly to physical behaviors, and more distantly, to the underlying processing mechanisms of the system being tested. However, accurate estimation of a sufficient set of classical kernels is often not possible for complex systems because the number of kernels that

need to be determined, and hence experiment time, increases radically with system memory, response frequency bandwidth, and non-linear interaction order.

("Improved Volterra Kernel Methods with Applications to the Visual System")

Name of the student :Rubel(2K17/CO/282)

27. To implement the Local Regression and Global Information-Embedded Dimension Reduction method.

The previous methods mainly ignore two facts in this step: 1) the dimensionality of the data is usually far larger than the number of local data, which is a typical ill-posed problem and 2) the data might be polluted by noise. These facts normally may lead to an inaccurate learned local structure and may degrade the final performance. This method is a novel unsupervised dimension reduction method with the ability to address these problems effectively while also preserving the global information of the input data. Firstly, the local data is denoised by preserving their principal components and then a regularization term to the local modeling function is applied to solve the ill posed problem. Then, a linear regression model is used to capture the local geometrical structure, which is demonstrated to be insensitive to the parameters. Finally, two criteria are proposed to simultaneously model both the local and the global information.

("Local Regression and Global Information-Embedded Dimension Reduction", IEEE TRANSACTIONS ON NEURAL NETWORKS AND LEARNING SYSTEMS, VOL. 29, NO. 10, OCTOBER 2018)

Name of the student: Aparajaita beejal (2K17/EP/016)

28. To implement Nonlinear Dimensionality Reduction Based on HSIC Maximization

Hilbert–Schmidt independence criterion (HSIC) is typically used to measure the statistical dependence between two sets of data. HSIC first transforms these two sets of data into two reproducing Kernel Hilbert spaces (RKHS), respectively, and then measures the statistical dependence between them using the Hilbert–Schmidt (HS) operator. This dimension reduction method is based on HSIC maximization between the high dimensional data and dimension-reduced data, and it is denoted as HSIC-NDR. In this method, the linear kernel is chosen as the kernel function of the RKHS of the low dimensional data after reduction, due to the reason that it can express dimensionality reduction data explicitly from the kernel matrix, thus facilitating the construction of the objective function of the data dimension reduction algorithm and the kernel

function of the RKHS of the original data set can be appropriately chosen according to the specific application.

("Nonlinear Dimensionality Reduction Based on HSIC Maximization", IEEE ACCESS 2018.)

Name of the student :Shikhar Malik(2K17/CO/321)

29. To implement Multidimensional signal interpolation based on parametric space dimension reduction

The dimension of a parametric space is reduced in the adaptive interpolation of a multidimensional signal. A hybrid adaptive interpolator underlies the dimensionality reduction. The multidimensional hybrid interpolator uses structurally different algorithms to interpolate multidirectional sections of the signal. The approximation of some sections of the signal by other sections underlies the interrelations between signal sections. The adaptive parametric interpolation of intra-sectional samples accounts for intra-sectional interrelations between signal samples. Computational experiments in real multidimensional signals prove the efficiency of the hybrid adaptive interpolator.

("Multidimensional signal interpolation based on parametric space dimension reduction", 2019 7th International Symposium on Digital Forensics and Security (ISDFS))

Name of the student: Yash(2K17/CO/382)

30. To implement Local Linear Dimensionality Reduction Algorithm Based on Nonlinear Manifolds Decomposition.

Aiming at the problem that linear data reduction algorithm is difficult to deal with data with nonlinear structure; this method proposes a new algorithm for facial expression feature extraction based on manifold decomposition algorithm. The algorithm utilizes the characteristic of local linearity of nonlinear manifolds. Through classical principal component analysis the local linear patches of nonlinear manifold structures are reduced in dimension. The local PCA representation can be obtained by local dimension reduction, and then the local coordinates are aligned by the coordinate arrangement technique, so that the low dimensional coordinates of the whole manifold can be obtained.

("Local Linear Dimensionality Reduction Algorithm Based on Nonlinear Manifolds Decomposition", 2017 International Conference on Network and Information Systems for Computers (ICNISC))

Name of the student: Abhinav Chudhary(2K17/IT/05)

31. To extract Spectral–Spatial Features for Hyperspectral Anomaly Detection

Hyperspectral anomaly detection faces various levels of difficulty due to the high dimensionality of hyperspectral images (HSIs), redundant information, noisy bands, and the limited capability of utilizing spectral–spatial information. This method address these problems and propose a novel approach, called spectral–spatial feature extraction (SSFE), which is based on two main aspects. In the spectral domain, it is assumed that the anomalous pixels are rarely present and all (or most) of the samples around the anomalies belong to background (BKG). Using this fact, a suppression function is introduced to construct a discriminative feature space and utilize a deep brief network to learn spectral representation and abstraction automatically that are used as inputs to the Mahalanobis distance (MD)-based detector. In the spatial domain, the anomalies appear as a small area grouped by pixels with high correlation among them compared to BKG. Therefore, the objects appearing as a small area are extracted based on attribute filtering, and a guided filter is further employed for local smoothness. More specifically, spatial features of anomalies are extracted only from one single band obtained by fusing all bands in the visible wavelength range. Finally, anomalies are detected by jointly considering the spectral and spatial detection results.

(“To extract Spectral–Spatial Features for Hyperspectral Anomaly Detection”, IEEE TRANSACTIONS ON GEOSCIENCE AND REMOTE SENSING, VOL. 57, NO. 10, OCTOBER 2019)

Name of the student: Aditya Krshna (2K17/IT/12)

32. To enhance an image using a Deep Residual Framework.

Owing to refraction, absorption, and scattering of light by suspended particles in water, raw underwater images have low contrast, blurred details, and color distortion. These characteristics can significantly interfere with visual tasks, such as segmentation and tracking. This method proposes an image enhancement solution through a deep residual framework. First, the cycle-consistent adversarial networks (CycleGAN) is employed to generate synthetic images as training data for convolution neural network models. Second, the very-deep super-resolution reconstruction model (VDSR) is introduced to underwater resolution applications; with it, the Underwater Resnet model is proposed, which is a residual learning model for underwater image enhancement tasks. Furthermore, the loss function and training mode are improved. A multi-term loss function is formed with mean squared error loss and a proposed edge difference loss. An asynchronous training mode is also proposed to improve the performance of the multi-term loss function.

("Underwater Image Enhancement With a Deep Residual Framework", IEEE ACCESS 2019.)

Name of the student: Hariharasudhan(2K17/SE/39)

33. To perform Low-Light Image Enhancement usingaA Pipeline Neural Network.

Low-light image enhancement is an important challenge in computer vision. Most of the low-light images taken in low-light conditions usually look noisy and dark, which makes it more difficult for subsequent computer vision tasks. In this paper, inspired by multi-scale retinex, a low-light image enhancement pipeline network based on an end-to-end fully convolutional networks and discrete wavelet transformation (DWT) are presented. First, the method shows that multiscale retinex (MSR) can be considered as a convolutional neural network with Gaussian convolution kernel, and blending the result of DWT can improve the image produced by MSR. Second, pipeline neural network is proposed, consisting of denoising net and low-light image enhancement net, which learns a function from a pair of dark and bright images.

("A Pipeline Neural Network for Low-Light Image Enhancement", IEEE ACCESS 2018.)

Name of the student: Sameer(2K17/CO/298)

34. To implement a Deep Hybrid Network for Low-Light Image Enhancement.

Camera sensors often fail to capture clear images or videos in a poorly lit environment. This method proposed a trainable hybrid network to enhance the visibility of such degraded images. The network consists of two distinct streams to simultaneously learn the global content and the salient structures of the clear image in a unified network. More specifically, the content stream estimates the global content of the low-light input through an encoder–decoder network. However, the encoder in the content stream tends to lose some structure details. To remedy this, a novel spatially variant recurrent neural network (RNN) is used as an edge stream to model edge details, with the guidance of another auto-encoder.

("Low-Light Image Enhancement via a Deep Hybrid Network",IEEE TRANSACTIONS ON IMAGE PROCESSING, VOL. 28, NO. 9, SEPTEMBER 2019).

Name of the student: Manish Kumar(2K17/CO/178)

35. To perform Low-Light Image Enhancement using Maximal Diffusion Values.

A vast amount of pictures are taken every day by using cameras mounted on various mobile devices. Even though the clarity of such acquired images has been significantly improved due to the advance of the image sensor technology, the visual quality is hardly guaranteed under varying

illumination conditions. The method for low-light image enhancement is proposed via the maximal diffusion value. The key idea of this method is to estimate the illumination component, which is likely to appear as the bright pixel even under the low-light condition, by exploring multiple diffusion spaces. Specifically, the illumination component can be accurately separated from the scene reflectance by selecting the maximal value at each pixel position of those diffusion spaces, and thus independently adjusted for the visual quality enhancement. That is, the maximal value among diffused intensities at each pixel position is adopted, so-called maximal diffusion value, as the illumination component since illumination components buried in the dark tend to be revealed with bright intensities through the iterative diffusion process

("Low-Light Image Enhancement Based on Maximal Diffusion Values", IEEE ACCESS 2019.)

Name of the student: Prateek Khare(2K17/CO/234)

36. **To implement a Wideband/Narrowband Fusion-Based Motion Estimation Method**

In this project, a fast motion parameters estimation method based on cross-correlation of adjacent echoes (CCAE) is adopted as the wideband estimation method. The narrowband estimation method is the maximum likelihood estimation with Newton's method (MN method). This method mainly includes three steps. First, the velocity and acceleration of the target are estimated by CCAE. Second, the velocity and acceleration estimated by CCAE are adopted as the initial velocity and final acceleration of MN method, respectively. Finally, the high precision velocity and distance of the target are estimated by MN method.

("A Wideband/Narrowband Fusion-Based Motion Estimation Method for Maneuvering Target", IEEE SENSORS JOURNAL, VOL. 19, NO. 18, SEPTEMBER 15, 2019)

Name of the student: Gaurav Garg(2K17/MC/043)

37. **To implement Representation Learning and Nature Encoded Fusion technique.**

A two-stage fusion method is used to solve the heterogeneous data fusion problem. First, the multi-modality data is transformed into the same representation form by a certain linear or nonlinear transformation. Since there is a model mismatch among the different modalities, each modality is trained by an individual statistical model. In this way, the information of different modalities is preserved. Then, the representation is used as the input of the probabilistic fusion. The probabilistic framework allows data from different modalities to be processed in a unified

information fusion space. The inherent inter-sensor relationship is exploited to encode the original sensor data on a graph. Iterative belief propagation is used to fuse the local sensing belief. The more general correlation case is also considered, in which the relation between two sensors is characterized by the correlation factor.

("Representation Learning and Nature Encoded Fusion for Heterogeneous Sensor Networks", IEEE ACCESS 2019.)

Name of the student: Ashish (2K16/MC/12)

38. To perform Spatial–Spectral Fusion by Combining Deep Learning and Variational Model

This project presents a fusion method that combines the deep neural network with a variational model for the most common case of spatial–spectral fusion: panchromatic (PAN)/multispectral (MS) fusion. Specifically, a deep residual convolutional neural network (CNN) is first trained to learn the gradient features of the high spatial resolution multispectral image (HR-MS). The image observation variational models are then formulated to describe the relationships of the ideal fused image, the observed low spatial resolution multispectral image (LR-MS) image, and the gradient priors learned before. Then, fusion result can then be obtained by solving the fusion variational model.

("Spatial–Spectral Fusion by Combining Deep Learning and Variational Model", IEEE TRANSACTIONS ON GEOSCIENCE AND REMOTE SENSING, VOL. 57, NO. 8, AUGUST 2019)

Name of the student: Divyankshi(2K17/CO/113)

39. Implementation of a PCA and Two-Stage Bayesian Sensor Fusion Approach

In this project, a sensor fusion approach based on the combination of a two-stage Bayesian method and principal component analysis (PCA) is used for diagnosing both electrical and mechanical faults in induction motors. Acoustic, electric, and vibration signals are gathered from motors operating under different loading conditions and health states. The inclusion of the PCA step ensures robustness to varying loading conditions.

("A PCA and Two-Stage Bayesian Sensor Fusion Approach for Diagnosing Electrical and Mechanical Faults in Induction Motors", IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS, VOL. 66, NO. 12, DECEMBER 2019)

Name of the student: Parv Gupta(2K17/SE/79)

40. To implement voting based Fusion Method for CNN-Based Automatic Modulation Classification

An automatic modulation classification has a very broad application in wireless communications. Recently, deep learning has been used to solve this problem and achieved superior performance. In most cases, the input size is fixed in convolutional neural network (CNN)-based modulation classification. However, the duration of the actual radio signal burst is variable. When the signal length is greater than the CNN input length, how to make full use of the complete signal burst to improve the classification accuracy is a problem needs to be considered. In this project, voting-based fusion method is used to solve this problem.

("Fusion Methods for CNN-Based Automatic Modulation Classification", IEEE ACCESS 2019.)

Name of the student: Ankit (2K17/SE/08)

41. Implementation of Data-Driven Dynamic Data Fusion Method Based on Visibility Graph and Evidence Theory

Dynamic data fusion on time series plays an important role in real applications like target identification. The existing credibility decay models (CDM) may be too subjective for parameters setting and do not make full use of time series information. To address these issues, a new method based on visibility graph and Dempster–Shafer evidence theory are presented in this project. With the assist of a visibility graph averaging aggregation operator (VGA), a structure revision basic belief assignment (SRBBA) which contains past time information can be obtained. Through this way, the judgment to past data credibility is data driven without the interference of subjective factors and more reasonable because more time information is considered.

("A Data-Driven Dynamic Data Fusion Method Based on Visibility Graph and Evidence Theory", IEEE ACCESS 2019.)

Name of the student: Piyush Khanna (2K17/CO/224)

42. To perform Efficient Multiple Kernel k-Means Clustering With Late Fusion

The recently proposed multiple-kernel clustering algorithms have demonstrated promising performance in various applications. However, most of the existing methods suffer from high computational complexity and intensive time cost. The multiple kernel k-means clustering via a late fusion manner method address this issue. In specific, we design two multiple kernel k-means

algorithms with late fusion, whose computational complexities linearly grow with the number of samples. The proposed algorithms integrally optimize the various clustering matrices into the optimal consensus clustering results iteratively.

("Efficient Multiple Kernel k-Means Clustering With Late Fusion",IEEE ACCESS 2019.)

Name of the student: Ritika jaiswal(2K17/CO/273)

43. Railways Night Vision Project

Name of the Student: Anirudh Nakra(2K17/EC/22)

44. Pre surgery image reconstruction by Max hospital

Name of the Student: Adya Aggarwal (2K17/EC/09)