PRS List of projects:

1. **Building a hierarchy of pedestrian contours using the hierarchical clustering technique.**
    - a set of pedestrians contours (models) is given - black contour on white background;
    - you will study different metrics for assessing the distance between any two models;
    - you will implement a suitable (fast, robust) metric distance between any two models;
    - you will study the hierarchical clustering algorithms;
    - you will implement a hierarchical clustering algorithm (eg. *single-linkage clustering, complete linkage clustering*) used for models clustering;
    - you will implement the hierarchy building; then the tree structure of hierarchy will be displayed as a diagram - *dendrogram*.

2. **Content based video sequences retrieval by analysis of a set of features.**
    - a color image and a set of color video sequences (short length) are given;
    - you will compute a vector of relevant features for the given image (color, shape, texture, histogram of oriented gradients, etc.);
    - the same array of features will be computed for the sequence of frames from each video sequence;
    - you will study various metrics to assess the distance between the vectors of features (picture – video frame) and implement only one;
    - you will implement a classifier for retrieving those video sequences that have the feature vectors relatively close to the given image data feature vectors;
    - the final result is to identify those videos that have a relatively similar content to that of the given image.

3. **Romanian vehicle license plates recognition from color images.**
    - color images of vehicles (at different distances) with visible license plates are given (the license plates can be a little bit rotated to the horizontal direction and their contained characters may have different spacing);

- you will implement an algorithm to identify the areas where the license plates are located;
- you will extract features (invariant to rotation and translation) of the characters from the plates;
- a classifier based on the considered features that will recognize the characters from the license plates will be implemented;
- the result is a text display of the recognized license plates characters.

4. **Extracting a set of pedestrian contours from grayscale images by automatic method of background subtraction.**
    - a sequence of intensity images having fixed background is given;
    - the difference from one frame to another is the movement of a pedestrian / pedestrians in the scene (background remains unchanged);
    - you will study and implement a robust method (invariant to small changes in lighting, the presence of noise, pedestrians shadow suppression) to remove the background and extract the contours of pedestrians who appear in the sequence of images;
    - the contours will be refined and you will obtain continuous contours that better approximates those pedestrians (one continuous contour for each pedestrian);
    - the result will consist in storing and displaying the obtained contours.

5. **Principal components analysis (PCA) for selecting the relevant features.**
    - you will implement and test the PCA algorithm for a generic set of features (a set of features instances is given);
    - sets of points (pedestrian extracted features) are given representing pedestrians contours;
    - the pedestrians contours will be normalized to obtain and have a constant number of points evenly distributed on each contour;
    - PCA algorithm will be applied on these normalized contours and the principal vectors will be obtained;
    - you will generate new pedestrians contours starting from the previously computed principal vectors.

6. **Detection of road signs and traffic lights in the scene.**
    - color images that contain (at different distances and with possible small deviations from normal position) road signs with circular, triangular or rectangular shape, and traffic lights (three colors) are given;
    - you will study and implement a robust method (invariant to lighting conditions, noise, small rotations, etc..) to detect all the road signs and the traffic lights that appear in images;
    - the result consists in marking of all road signs and traffic lights that are discovered (or areas where they are located) over the original images.

7. **Face detection in color images with different objects.**
    - color images with various objects (one object in the picture) are given; an object can/cannot contain a face;
    - you will study and implement a robust method (invariant to lighting conditions, noise, distance, partial view, etc..) for face detection by extracting a relevant vector of features;
    - you will train a classifier which will be used subsequently to detect faces;
    - the result will consist in marking the area (a rectangle) that contains a face over the original image.

8. **Barcode recognition from grayscale/color images.**
    - intensity/color images with different objects that have visible barcodes are given (a single barcode in the image having EAN-13 format – specific to the majority of products from Romanian stores);
    - you will study and implement a robust method (invariant to different lighting conditions, rotation, distance, perspective, etc.) for barcode detection and recognition;
    - The result will consist in displaying the 13 digits text sequence of the recognized barcode.

9. **Iris recognition from images.**
    - you will study some person identification techniques based on iris recognition; you have to choose one of them for implementation;
    - get a set of eyes images from different persons;
    - preprocess the images and extract some relevant iris features;

- apply a pattern-recognition technique on the feature space for determining if two iris-images belong to the same person;
- get an unknown new iris image and find who is the person having that iris (if you can find a similarity).

10. Fingerprint recognition from images.

- you will study some person identification techniques based on fingerprint recognition; you have to choose one of them for implementation;
- get a set of fingerprint images from different persons;
- preprocess the images and extract some relevant fingerprint features;
- apply a pattern-recognition technique on the feature space for determining if two fingerprint-images belong to the same person;
- get an unknown new fingerprint image and find who is the person having that fingerprint (if you can find a similarity).

11. Offline signature verification.

- you will have to study and implement an offline handwritten signature verification algorithm;
- get and store a set of handwritten signatures images for a number of different persons (a set for each person);
- preprocess the images and extract some relevant features for each signature;
- find the authenticity of a writer by comparing an input signature to the stored reference set.

12. Obstacle detection using monocular vision

- color images with traffic scenes acquired with a smartphone camera are given;
- you will have to study and implement a robust real-time application for obstacles detection (static and dynamic obstacles);
- the result will consist in marking the area (a rectangle) that contains an obstacle over the original image.
- the implementation could be made on Android.

13. Pedestrian recognition using monocular vision

- color images with traffic scenes acquired with a smartphone camera are given;
- you will have to study and implement a robust real-time application for pedestrians detection
- the result will consist in marking the area (a rectangle) that contains a pedestrian over the original image.
- the implementation could be made on Android.

14. Fog detection and image enhancement with monocular vision

- color images with traffic scenes acquired with a smartphone camera are given;
- you will have to study and implement a robust real-time application for fog detection and image enhancement
- the objective is to improve visibility (fog elimination) in the way of obtaining clearer images;
- the implementation could be made on Android.

15. Semantic segmentation of color images

- color images with traffic scenes acquired with a monocular camera are given;
- you will have to study and implement an approach for semantic segmentation at pixel/superpixel - level
- a set of possible classes should be defined (e.g. vegetation, road, pedestrian, traffic sign, pole, walking area, etc.)
- each pixel/superpixel should be classified as one of those defined classes

16. Obstacle detection from 3D point cloud

- a 3D point cloud acquired by several LIDARs is given;
- you will have to study and implement an approach for detecting the obstacles
- an obstacle could be defined by a set of 3D points that are in the same neighborhood (vicinity criteria)
- all the detected obstacles could be represented by their 3D bounding box

17. Vehicle classification from images

- a set of images containing the 2D bounding boxes of several vehicles is given;
- you will have to study and implement an approach for classifying the vehicles
- each vehicle should receive one class (e.g. sedan, minibus, SUV, etc.)

18. Handwritten text recognition

- an image containing handwritten text is given;
- you will have to study and implement an approach for text recognition
- all the containing handwritten words should be recognized and printed in a text file

19. Hand gesture recognition

- several images containing different static hand gestures are given;
- you will have to study and implement an approach for hand gesture recognition
- a set of possible gestures is defined
- each hand gesture should be classified as one from the defined set

20. Painted road signs detection from images

- several images containing different painted road signs are given;
- you will have to study and implement an approach for painted road signs detection
- each painted road sign should be identified (e.g. lane marking, pedestrian crossing, forward arrow, forward+left arrow, etc.)