1. (10 points) Now AI is becoming a hot area, both in industry and in academic world. One of the most important technologies in this field is deep learning.
   1) (3 points) Please list at least 5 open-source platforms used for deep CNN.
   2) (3 points) Please list at least 5 widely used DCNN architectures.
   3) (2 points) Please list at least 5 DCNN-based object detectors.
   4) (2 points) Please list at least 4 GPU types used for deep model training.

2. (10 points) CRC_RLS is an effective face classification model proposed recently. Its core problem is to solve a ridge regression problem, \( x_0 = \arg \min_x \| y - Ax \|_2^2 + \lambda \| x \|_2^2 \).

   Please prove that this equation has a close-form solution, \( x_0 = \left( A^T A + \lambda E \right)^{-1} A^T y \) where \( E \) is the identity matrix.

3. (10 points) Recently, sparse representation-based classification (SRC) has been proved to be quite effective for face classification. Please describe basic steps for a SRC-based face recognition approach.

4. (10 points) Suppose that we have a car and four wide-angle cameras are mounted on the front side, the left side, the back side, and the right side of the car body. Your task is to design a vision-based parking-slot detection module for the car. This is actually a critical component in a self-parking system. It is expected that such a module can detect the existing parking-slots (marked by parking-lines painted on the ground surface) nearby and returns the coordinates (with respect to the vehicle coordinate system) of the four corners of the parking-slots to the path-planning module. Suppose you are exposed to this task. What is your solution? Please give as many details as possible.

5. (10 points) Suppose that we have a dataset \( X = \{ \mathbf{x}_i \}_{i=1}^{N} \) conforms to a GMM whose probability density function is \( p(\mathbf{x}) = \sum_{l=1}^{K} \alpha_l \mathcal{N}(\mathbf{x} | \mathbf{\mu}_l, \mathbf{\Sigma}_l) \), s.t. \( \sum_{l=1}^{K} \alpha_l = 1 \). For a given data \( \mathbf{x}_i \), what is the probability that \( \mathbf{x}_i \) belongs to \( l \)th Gaussian component, i.e., \( p(l | \mathbf{x}_i) \)?