1. **Representation Learning for Tabular Data**

   Learning good representations is one of the most important parts of building classifiers or other predictors [1]. Recently, representation learning for images and languages has been realized through deep neural network models such as ResNet [2] and BERT [3]. However, we still need to devise a new model (similar as [4]) to provide good representations for tabular data that maybe multimodal. For example, patient or customer data include discrete and numeric values in the table as well as texts and images. It is also necessary to develop a new algorithm which has the model updated continuously as the data accumulate.


2. **Ensemble Learning with Neural Architecture Search**

   While good building blocks of the best neural network architecture for a given task can be found automatically by neural architecture search (NAS), human experts are still required to combine those blocks. AdaNAS [1] uses ensemble techniques to compose a neural network as an ensemble of smaller networks automatically. However, this algorithm uses a very simple subnetwork generator which just increases the size of previous subnet works at each iteration. Thus, it is necessary to develop a new ensemble learning algorithm to build the best ensemble classifier which consists of multiple diverse base neural networks found by NAS.


3. **Semi-supervised Learning in an extreme scenario**

   Background: Most of recent DL researches focus on supervised approaches with clear labels. But as we all agreed in the field, real data tend to be very imbalanced and challenging for even domain experts to labeling. If we have only a tiny portion of labeled and the rest unlabeled ones, how would you like to retrieve meaningful insights from both the labeled and
- Example scenario: Say we have a 3D cube-shaped dataset with size 1300 * 1300 * 1300, 2 billion of data points in total. Unfortunately only 2000 data points out of them are labeled, where each point is labeled to one out of three classes. The class labels ratio are as follows; class1 = 100, class2 = 500, class3 = 1400. We want to classify most of the unlabeled data while preventing overfitting as much as possible.
- Expected output: label predictions for unlabeled data

4. ML Optimization
- Data Augmentation, Model Complexity, Efficient Computation, Efficient Training, Hyper Parameter Optimization, etc.

5. Vision Inspection with imbalance data
- Technique to increase pseudo defect data
- Improve the model Performance with a few data set
- Model training optimization with transfer learning to overcome a few data set

6. Video Object Detection Technology
- Algorithm and Performance comparison
- Really small object (ring, human in 4k image, and etc…) detection or segmentation preserving the accuracy in big object general task oriented project