

# 有方-科研培养方案

专为计算机研讨班-张景浚，何祖伦设计

## 课题名称： RESEARCH ON IMAGE DIMENSIONALITY REDUCTION ALGORITHM

Dimensionality reduction, or dimension reduction, is the transformation of data from a high-dimensional space into a low-dimensional space so that the low-dimensional representation retains some meaningful properties of the original data, ideally close to its intrinsic dimension.

In large multimedia databases, it may not be practical to search through the entire database in order to retrieve the nearest neighbors of a query. Good data structures for similarity search and indexing are needed, and the existing data structures do not scale well for the high dimensional multimedia descriptors.

In this project, we need to propose a model of image dimensionality reduction algorithm that can achieve good performance in the field of image classification.

**PRECORE:** Python Basics and Common Packages; Basics of Calculus, Linear Algebra, Probability and Statistics; Basics of Machine Learning; Basics of Computer Vision

### 课题创新点：

The combination of state-of-the-art deep learning models and signal processing techniques to create a new algorithm of image dimensionality reduction.

### SCHEDULE 科研计划

\*TBA 为待确定具体时间

科研项目 – 教授/导师课程阶段

## 论文发表

### 科研项目 – 教授/导师课程阶段

(每次课 2 小时, 暑假期间导师课周六上午 8:00-10:00, 教授课暂定周日上午 10:00-12:00)

2021-06-04	Mentor Class 1	<b>Basics about Computer Vision:</b> <ul style="list-style-type: none"> <li>Basic knowledge about image dimensionality reduction algorithm</li> <li>Recent research of the image dimensionality reduction algorithm</li> </ul> <b>Assignment:</b> <ul style="list-style-type: none"> <li>Finish reading 3-5 key related works and write summary</li> </ul>
2021-06-18	Mentor Class 2	<b>Machine learning in Image Dimensionality Reduction:</b> <ul style="list-style-type: none"> <li>Machine learning approaches for image dimensionality reduction</li> </ul> <b>Assignment:</b> <ul style="list-style-type: none"> <li>Write a draft research plan</li> <li>Read literature and write literature review</li> </ul>
2021-06-27	Professor Class 1	<b>The Introduction to Artificial Intelligence</b> <ul style="list-style-type: none"> <li>The Basis of Machine Learning</li> <li>The Basis of Deep Learning</li> </ul>
2021-07-04	Professor Class 2	<b>The Introduction to Computer Vision</b> <ul style="list-style-type: none"> <li>The importance of CV</li> <li>The application of CV in environment</li> </ul>
TBA	阶段性考察汇报	
2021-07-10	Mentor Class 3	<b>Machine learning fundamentals:</b> <ul style="list-style-type: none"> <li>Basic machine learning pipeline</li> <li>Overfitting and model selection</li> </ul> <b>Assignment:</b> <ul style="list-style-type: none"> <li>Read blogs about basic concepts of machine learning</li> <li>Follow Python tutorials to build machine learning models</li> </ul>

2021-07-17	Mentor Class 4	<b>Deep learning fundamentals:</b> <ul style="list-style-type: none"> <li>Neuron model and multi-layer dense neural network</li> <li>Stochastic gradient decent</li> </ul> <b>Assignment:</b> <ul style="list-style-type: none"> <li>Summarize the core concepts of deep learning</li> </ul>
2021-07-25	Professor Class 3	<ul style="list-style-type: none"> <li><b>Academic Writing</b></li> <li><b>Review Students' Presentation</b></li> </ul>
2021-07-31	Mentor Class 5	<b>Data collection and preprocessing:</b> <ul style="list-style-type: none"> <li>Obtain image data</li> <li>Preprocess the data using signal processing techniques</li> </ul> <b>Assignment:</b> <ul style="list-style-type: none"> <li>Finish data preprocessing</li> <li>Write the Introduction and Method of Paper</li> </ul>
TBA	<b>阶段性考察汇报</b>	
2021-08-07	Mentor Class 6	<b>Feature engineering:</b> <ul style="list-style-type: none"> <li>Extract useful features from the data</li> </ul> <b>Assignment:</b> <ul style="list-style-type: none"> <li>Finish creating of the features</li> <li>Write the Feature engineering of Paper</li> </ul>
2021-08-14	Mentor Class 7	<b>Baseline machine learning model development:</b> <ul style="list-style-type: none"> <li>Train baseline models</li> <li>Evaluate the model performance</li> </ul> <b>Assignment:</b> <ul style="list-style-type: none"> <li>Finish baseline model development</li> <li>Write the baseline model part of Paper</li> </ul>

2021-08-21	Mentor Class 8	<b>Deep learning model development</b> <ul style="list-style-type: none"> <li>Build first version of the deep neural network</li> <li>Evaluate the model performance</li> </ul> <b>Assignment:</b> <ul style="list-style-type: none"> <li>Finish the deep learning model</li> <li>Finish the paper</li> </ul>
TBA	Professor Class 4	<b>Review Students' Presentation</b>
TBA	<b>阶段性考察汇报：有方审核，论文定稿</b>	
TBA	论文发表启动（确定投稿目标期刊/会议）	
TBA	论文发表收录	