

Weibin WANG, Doctoral Program 2<sup>nd</sup> Year, Graduate school of Information Science and Engineering

## Introduction

### Background & Contribution

**Background :** Hepatocellular carcinoma (HCC) is a kind of liver cancer (one of the leading causes of death worldwide). Microvascular invasion (MVI) is an important factor leading to postoperative early recurrence. However, the diagnosis of MVI depends on postoperative pathological verification, which is difficult to predict before surgery.

**Contributions:**

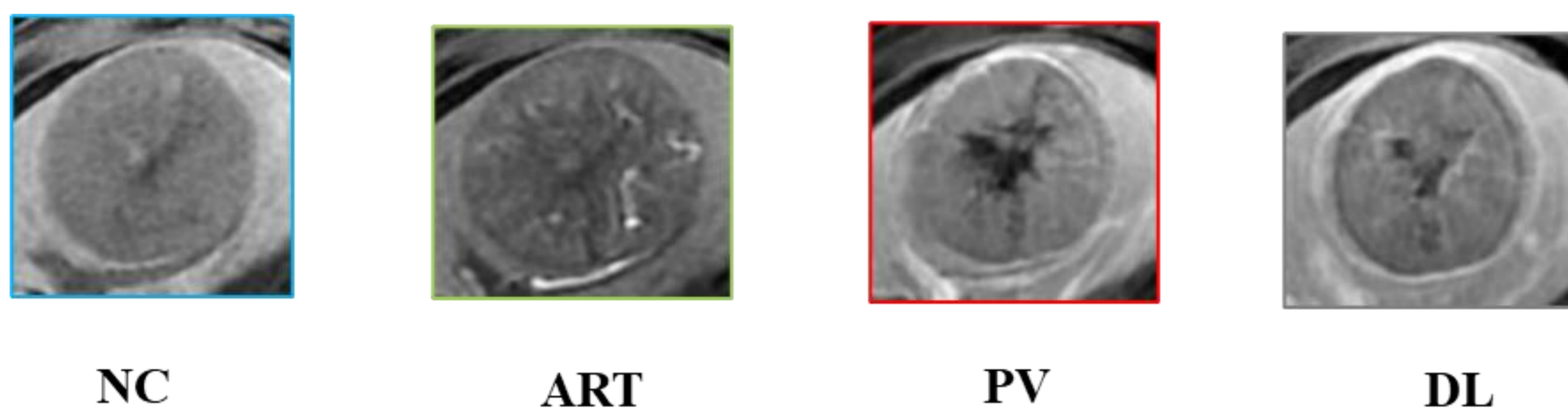
- (1) We use deep learning method to extract the features of multi-phase MRI and compared the performance of different phases.
- (2) We propose a phase attention module to improve the deep learning model.

### Clinical data & MR imaging

Table 1. Clinical information

Features	Chi-Square	P-value
ALB	-1.085	0.025
AFP	0.844	0.004
Capsule	-0.687	0.015
Corona enhancement	1.353	0.001

Figure 1. Example MR images of HCC over four-phases



## Proposed method

### Radiomics model

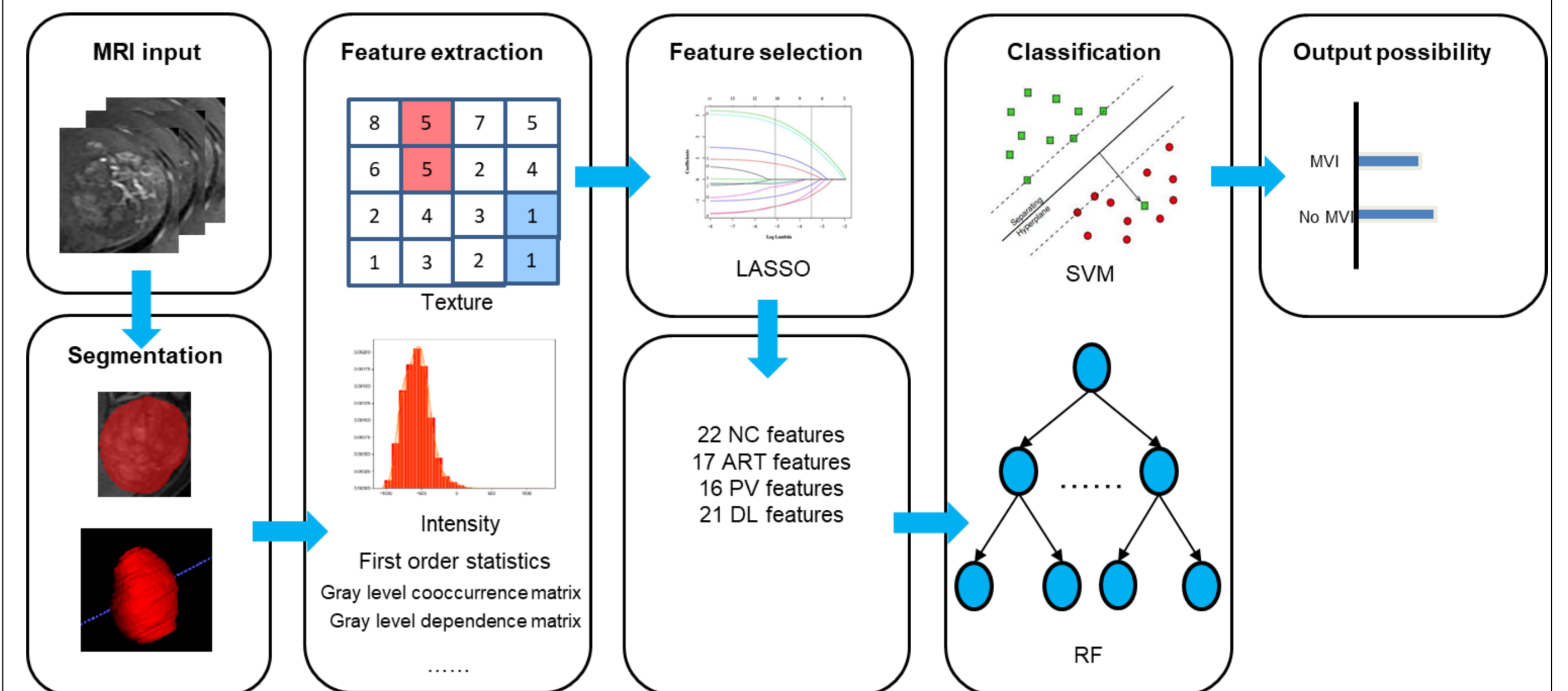


Figure 2. Framework of radiomics model

### PAM model

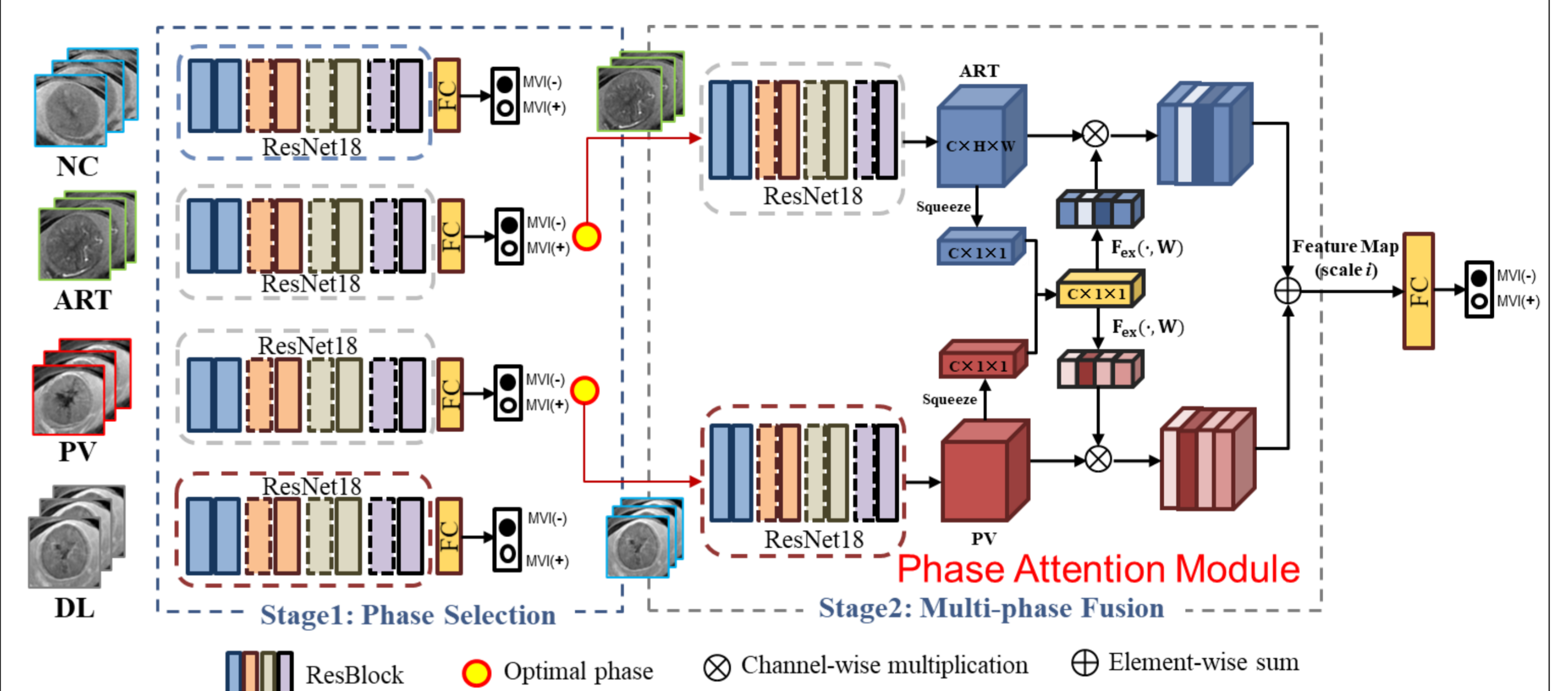


Figure 3. Deep learning models with Phase Attention Module

## Experimental Results & Findings

### Results

Table 2. Main experimental results

Model	ACC	AUC	Sensitivity	Specificity	PPV	NPV
DL	0.746	0.747	0.652	0.797	0.536	0.864
DL (PAM)	<b>0.782</b>	<b>0.810</b>	0.625	0.828	0.577	0.869
Radiomics model [1]	0.758	0.673	0.260	0.890	0.461	0.770
Clinical model [2]	0.722	0.759	0.489	0.859	0.550	0.821

- (1) Our proposed DL (PAM) model is superior than the conventional radiomics model and clinical model.
- (2) Phase Attention Module effectively improves the prediction performance.

### Findings



This research trip focused on communicating with overseas doctors and researchers. The time expected to do experiment was more than originally planned. However, in general, I think this is a successful collaborative project: I have gained a lot of knowledge and theoretical methods through discussions with professors and researchers at Zhejiang University. Thanks for the KOKUSAITEKI Research Fund to support my research.

## Future work

- (1) Combine clinical features, radiomics features with deep learning features.
- (2) Build a multimodal prediction network.
- (3) Continue to cooperate with overseas researchers.



Intelligent Image Processing Lab.

## Reference

[1] R. Zhang, Lei, et al. "A nomogram based on bi-regional radiomics features from multimodal magnetic resonance imaging for preoperative prediction of microvascular invasion in hepatocellular carcinoma," *Quantitative imaging in medicine and surgery*, 9(9):1503-1515, 2019.  
 [2] Z. Lei, et al. "Nomogram for Preoperative Estimation of Microvascular Invasion Risk in Hepatitis B Virus-Related Hepatocellular Carcinoma Within the Milan Criteria," *JAMA Surg.* no.151, pp.356-358, 2016.