1. Project Names:

Classification of Multi-View Deep Convolutional Neural Network-Based Mammography Images

2. Overview:

Cancer covers a broad spectrum of diseases characterized by abnormal and uncontrolled proliferation of cells in any part of the body. Cancer, which ranks second among the causes of death worldwide, is also a serious health problem in our country. According to the World Health Organization, breast cancer is the most common type of cancer in women based on age-standardized cancer incidence rates (2020).

When examined according to cancer death rates in women, while breast cancer ranks first worldwide, it ranks second after lung cancer in our country (World Health Organization, 2020). Since cancer is among the non-communicable diseases, an effective combat strategy is important for public health. In this context, primary and secondary prevention measures play a vital role.

Within the scope of secondary prevention, early diagnosis of breast cancer is of great importance. Early diagnosis means screening individuals who do not show symptoms and diagnosing individuals who develop symptoms at an early stage. The most commonly used imaging method for early diagnosis of breast cancer is mammography, which is obtained with X-rays. With the widespread use of mammography in practice, the Breast Imaging-Reporting and Data System (BI-RADS) began to be used for the first time in 1993. This system includes a structured report template and patient management recommendations. Today, the 5th version, updated by the American College of Radiology (ACR) in 2013, is used.

3. Background:

The relevant study is planned to be carried out using convolutional neural networks. In this study, state-of-the-art (SOTA) architectures will be tested and their performances will be reported. In addition to classical classification processes, the multi-view deep convolutional neural network method will be used in the training process.

4. Key Objectives / Business Objectives:

Two classification processes will be carried out in the project. The first classification process will be done according to composition (density degree), and the second classification process will be done according to BI-RADS category (tumor level).

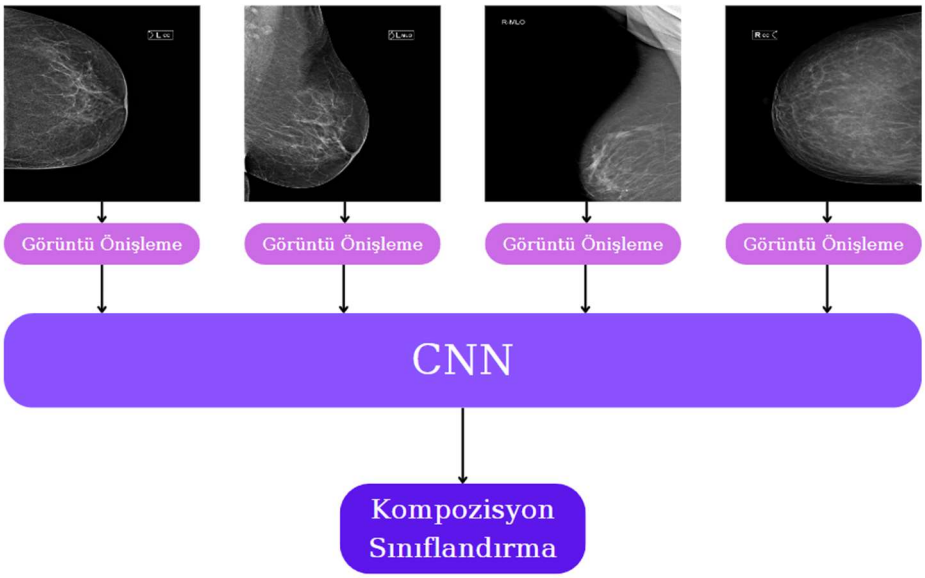


Figure 1. Scheme of the composition classification process

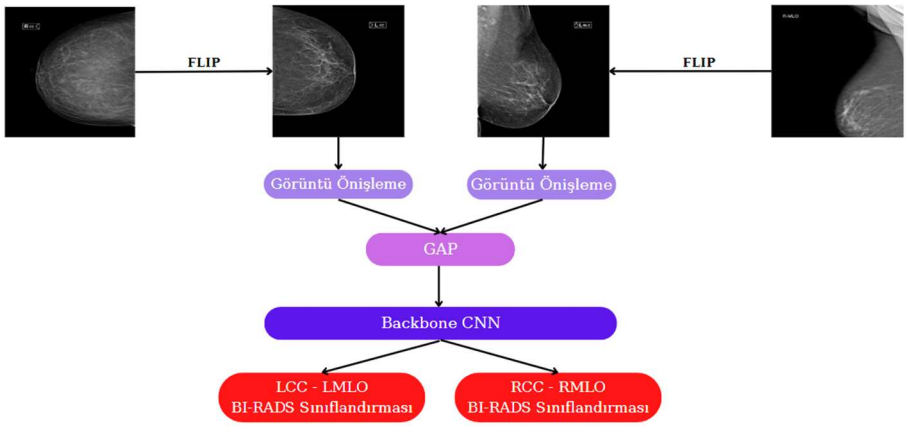


Figure 2. Scheme of the classification process of the BIRADS category

4.1. Research Questions:

• What is multi-view architecture and what are its advantages?

• Which architecture will you use as the backbone when creating the model?

4.2. Key Steps:

• Data Collection: Obtaining and using labeled mammography images by radiologists.

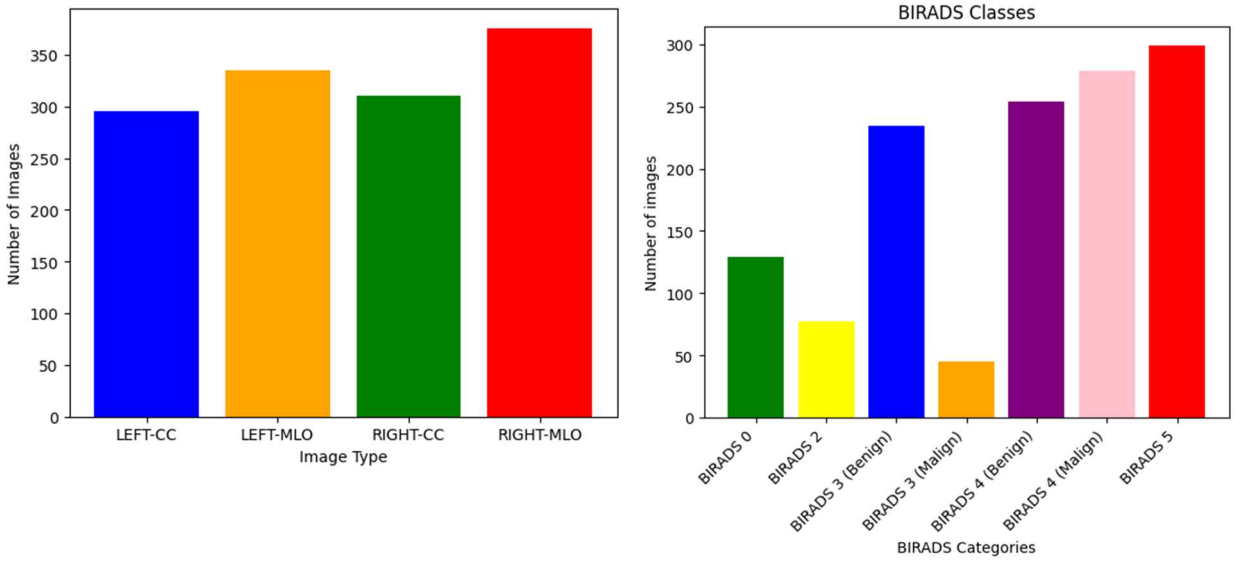
• Image Preprocessing: Testing the image preprocessing steps that can be used in this study.

• Model Development and Training: Using and training convolutional neural networks developed for classification purposes

• Performance Evaluation: Obtaining the results of the developed model using performance evaluation metrics.

5. Methods and Workflow

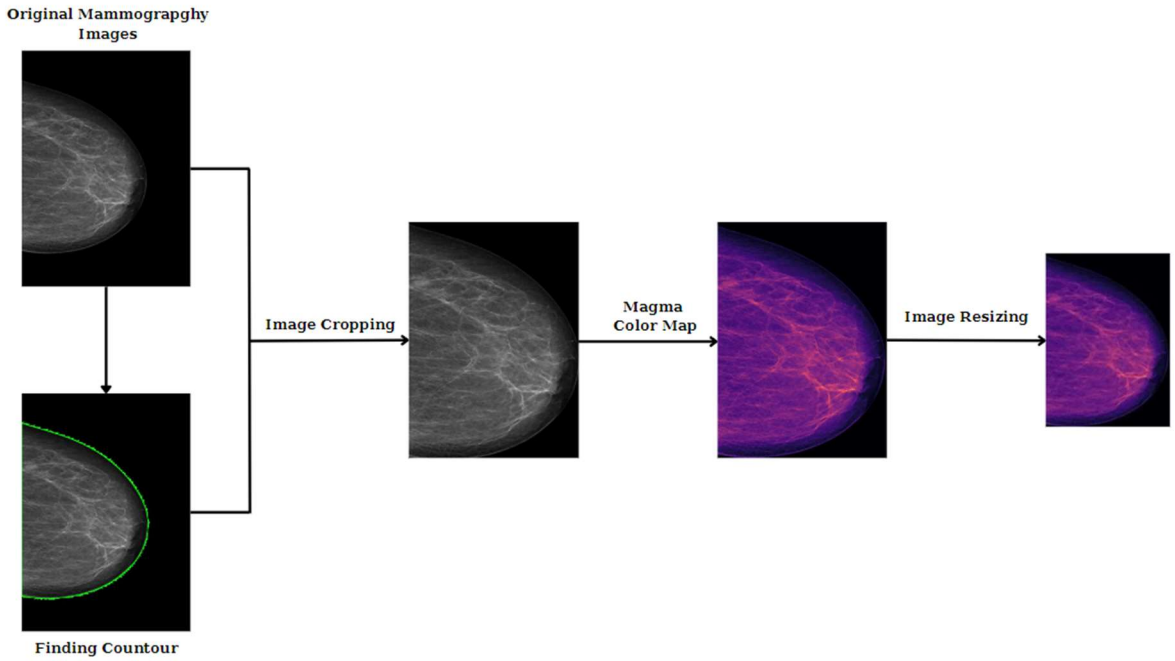
5.1. Datasets:



The data set used in the study consists of the open source CBIS-DDMS data set. Since the CBIS-DDMS dataset contains only images of patients with tumors, there are no images belonging to the BIRADS 1 category. For this reason, the INbreast data set will be used if necessary.

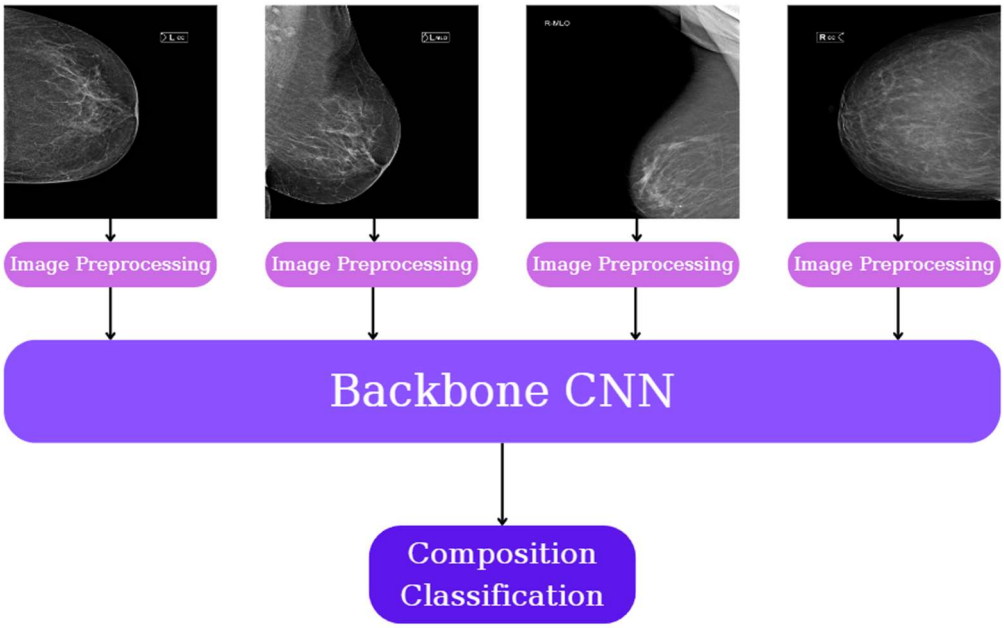
5.2 Data Cleaning / Preprocessing:

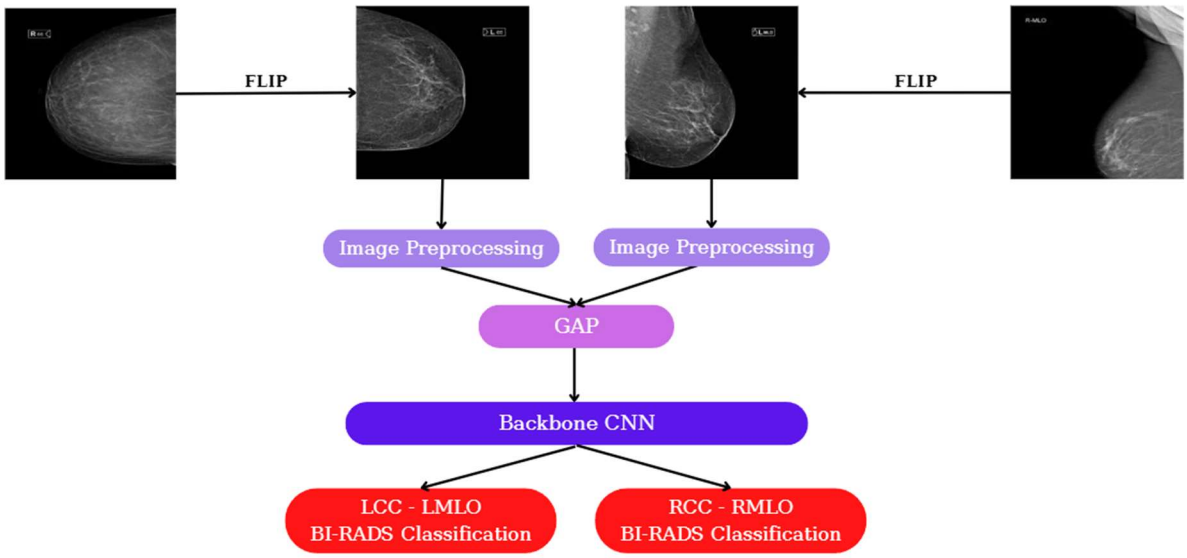
In order to get rid of unnecessary black area in the images in the data set, contour detection was performed and a cropping process was performed so that only the relevant image was in the picture. Afterwards, the color space of the images was changed from black-white format to magma color space. When the literature research was conducted, this process increased the success rate in composition classification from 66.83% to 74.94%.



5.3. Modelling:

In artificial intelligence model development, multi-view CNN was used instead of single-view CNN. Although CC and MLO views are images from different angles, they carry complementary information. For this reason, this method was chosen.





5.4. Deliverables: