



The 47<sup>th</sup> International Conference  
**APPLICATIONS OF MATHEMATICS IN ENGINEERING AND ECONOMICS  
(AMEE 2021)**

# Biomedical Image Classification Algorithms Evaluation

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Covid-19 tests

Real-Time Polymerase Chain Reaction  
(RT-PCR)

Medical Imaging

# Real-Time Polymerase Chain Reaction (RT-PCR)

## Disadvantages:

1. the option of error occurrence
2. the time consuming to identify the disease

## Medical Imaging

provides clear evidence for disease  
occurrence and enables its treatment

# Methods for Image Classification

Image Features  
Extraction  
and Similarity  
Analysis

Image Features  
Extraction  
and Artificial Neural  
Network

# Image Features Extraction and Similarity Analysis

## Tasks

1. Image features extraction and generating feature vectors on the base of primitive
2. Similarity computation on the base of similarity measure (Euclidean distance, Manhattan distance, Mahalanobis distance, Canberra distance, etc.)

# Image Features Extraction and Artificial Neural Network

## Tasks

1. Image features extraction and generating feature vectors on the base of primitive
2. Performing training using the generated feature vectors.
3. Query-Image processing on the base of tasks 1 and 2.

## Artificial Neural Network:

model of natural  
neural networks;

perform the functions  
of the human brain;

### Structure of ANN

a finite number of neurons connected to each other in a certain order and model to perform a specific task;



# Image Features Extraction and Artificial Neural Network

## Application

data classification on the base of extracted feature vectors in advance performing deep learning to learn the neural network for a new classification task

➤ Low-level features

1. Color
2. Shape
3. Texture
4. Layout

➤ Group classification

1. Spatial
2. Spectral

## ➤ Spatial group

- Computing statistical values
- Rotation invariance
- Insufficiency of number of features
- Sensitivity of image noise

## ➤ Spectral group

- Effectively measure image energy;
- Rotation and image noise resistant image feature vectors;
- i. g. Gabor filters, wavelet, Discrete Cosine Transform (DCT), curvelet, Discrete Wavelet Transform (DWT), contourlet;

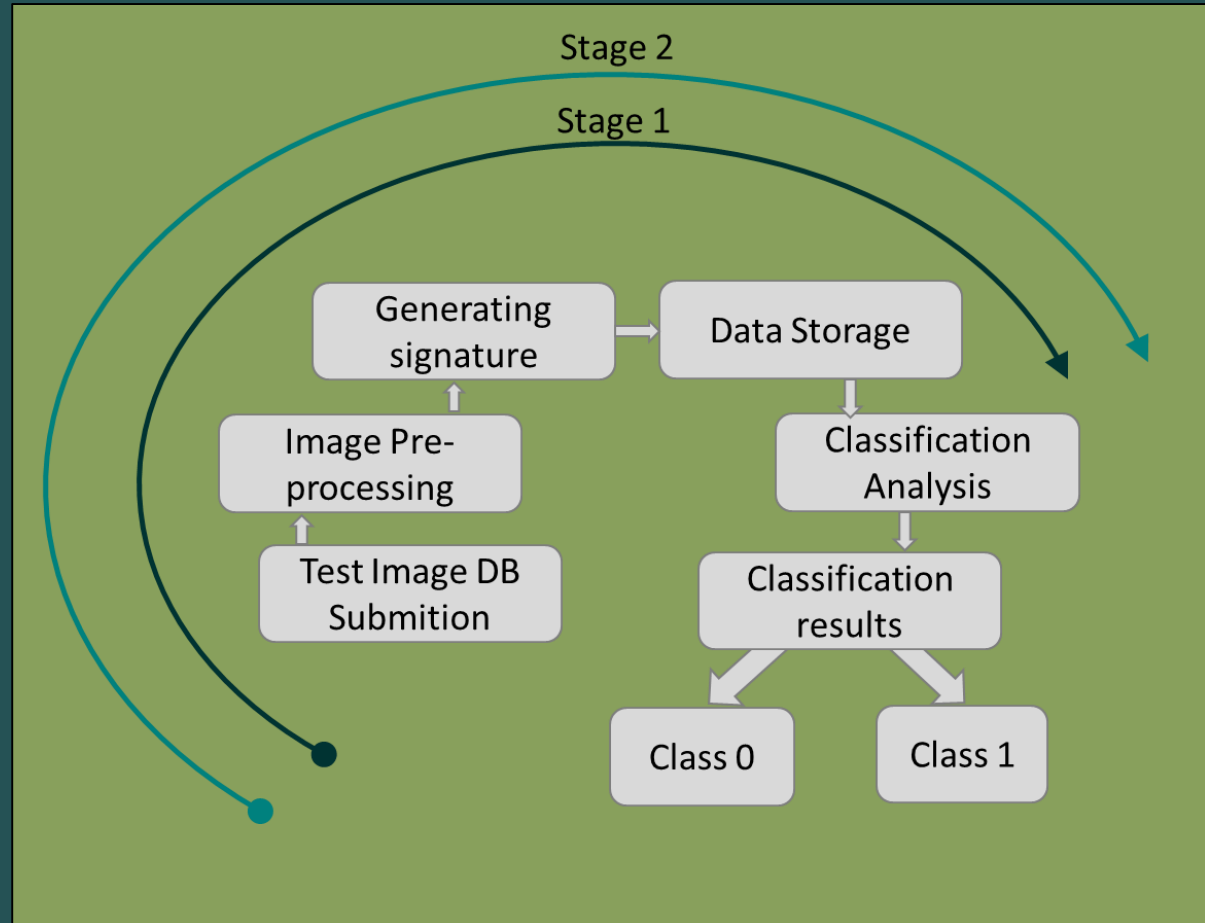
# The Dual-Tree Complex Wavelet Transform

- Complex Wavelet Transform (CWT)
- Complex valued scaling function
- Complex-valued wavelet

**Basic idea** – transform producing analytic signal (on the analogy of Fourier transform) with the following properties:

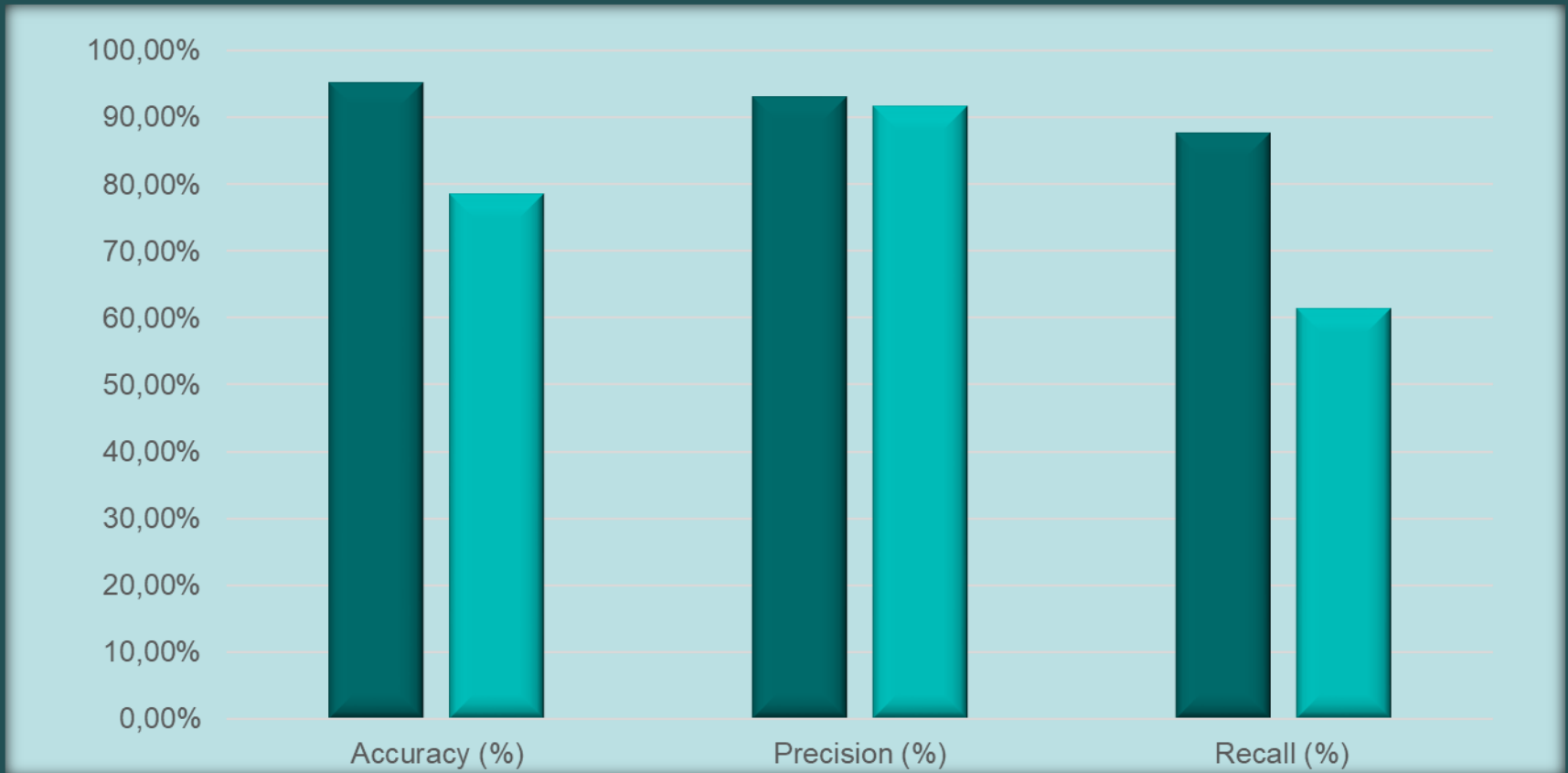
- Smooth non-oscillating magnitude
- Nearly shift-invariant magnitude
- Significantly reduced aliasing effect
- Directional wavelets in higher dimensions

# Algorithm and results



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# Experimental results



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Thank You!

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