Deep learning Implementation framework for Image Classification Applications

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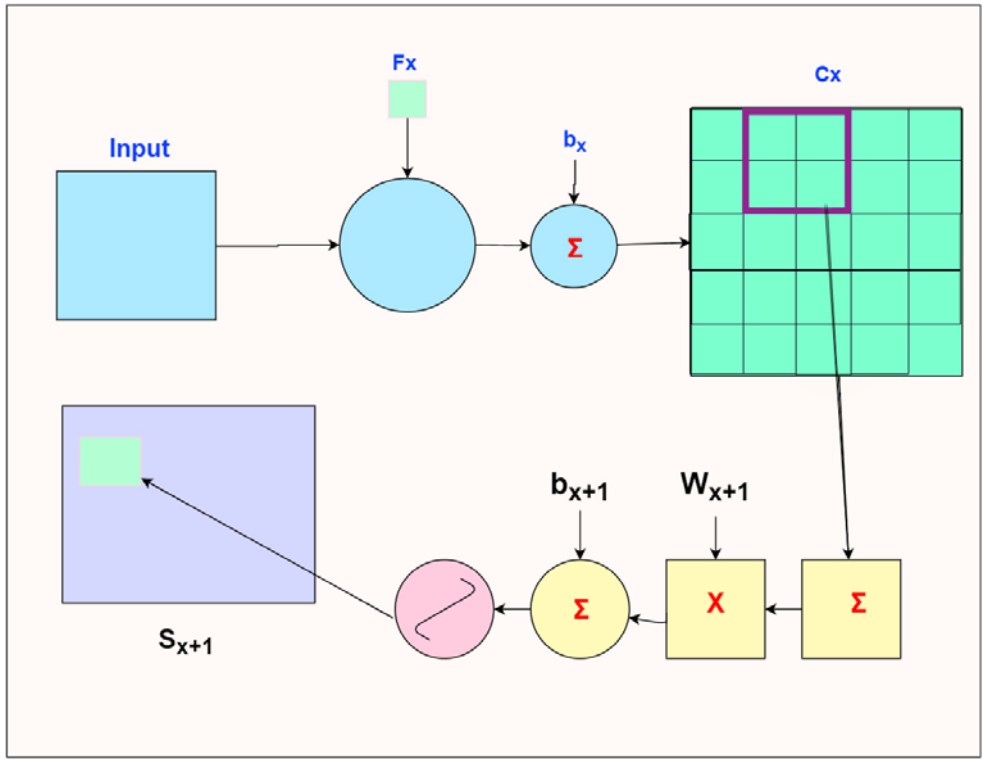
Research Area

- **Supervised Learning :** Is the machine learning task of inferring a function from labeled training data
- **Deep Learning :** Is a set of algorithms, that attempt to model high-level abstractions in data by using a deep graph with multiple processing layers, composed of multiple linear and non-linear transformations
- **Convolutional Neural Networks :** Is a type of feed-forward artificial neural network in which the connectivity pattern between its neurons is inspired by the organization of the animal visual cortex, whose individual neurons are arranged in such a way that they respond to overlapping regions tiling the visual field.



Convolution Neural Networks function

The Problem

- Train a deep learning model with images
- Demonstrate the usefulness of deep learning
- Create a deep learning tool for non-experts

The Proposed Solution

An implementation framework for deep learning

Creation of an easy platform to use

Followed by a web-application which use the aforementioned models

Related Work

- MatConvNet: A deep learning bookmark for Matlab
- Theano : Deep learning framework for python
- Digits: Deep Learning framework with GUI from NVidia
- TensorFlow: Deep Learning framework with GUI from Google Brain

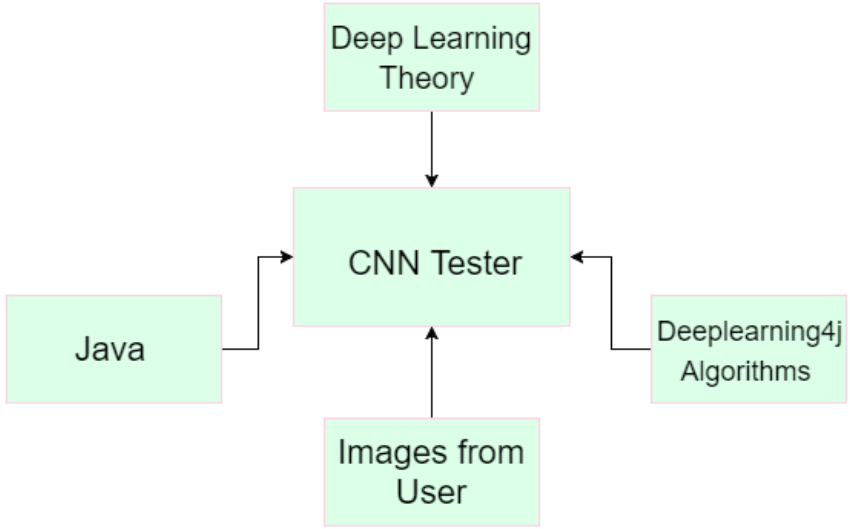
Our Development: Tools used

- Java language implementation
- Server Apache Tomcat
- Deeplearning4j framework
- Ajax

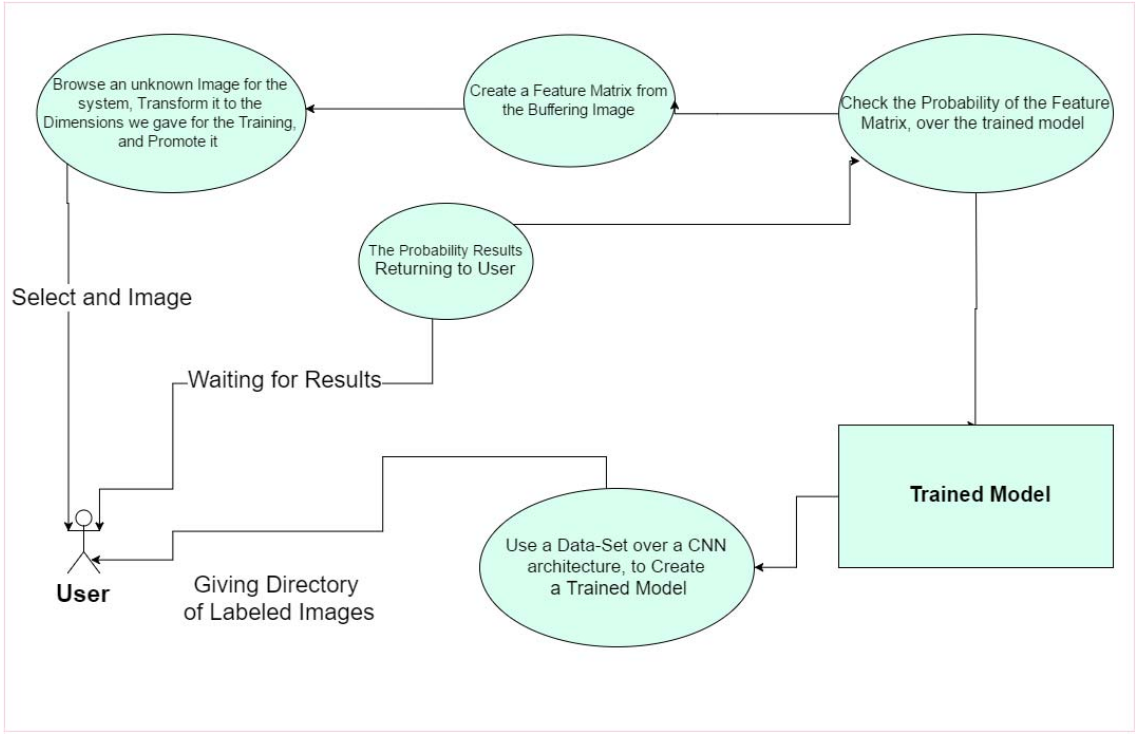
Our Development: The two different Approaches

- Desktop Application (CNNs-Tester)
- Web application (PatternF)

Desktop Application CNNs-Tester

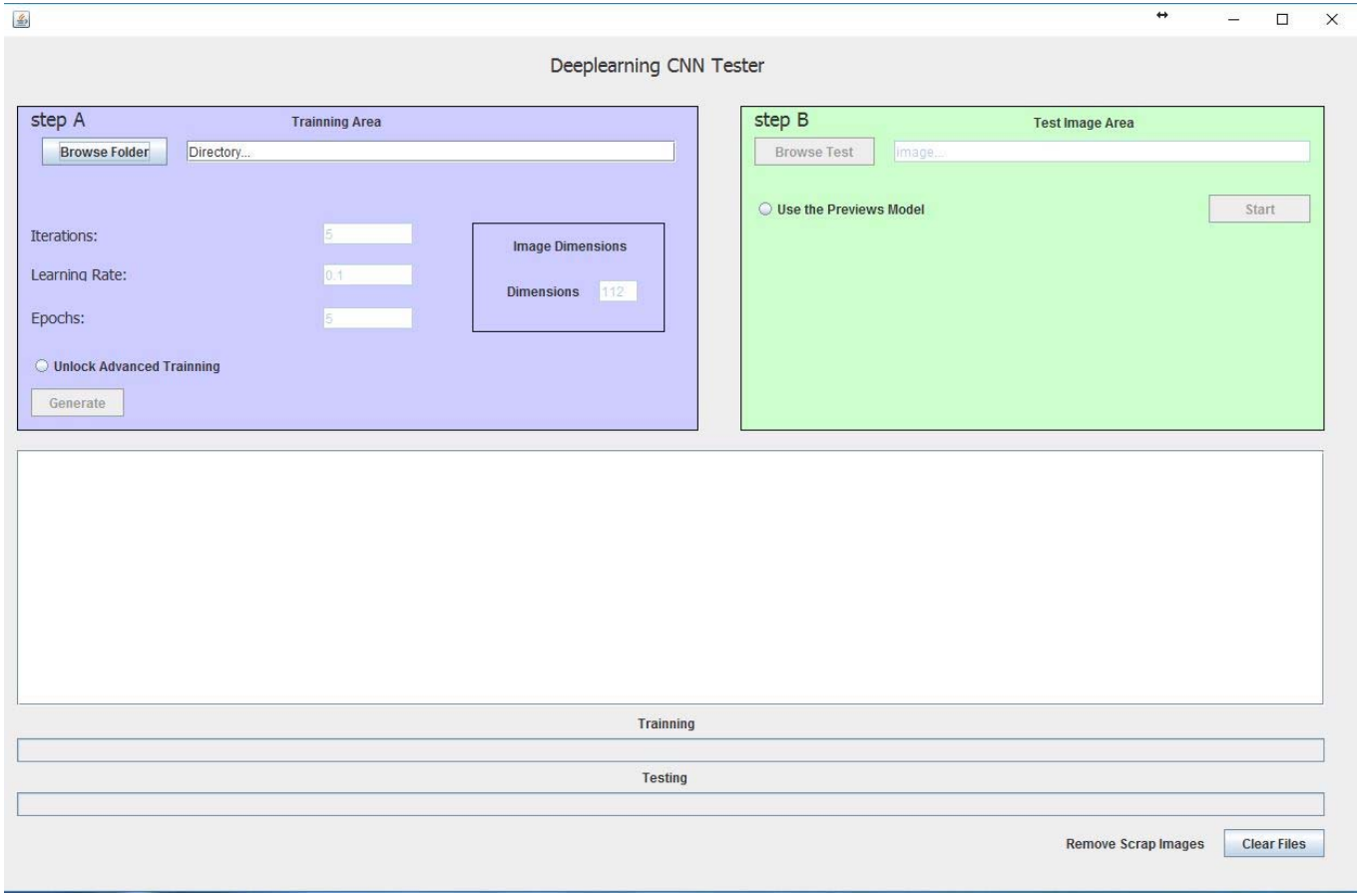


CNNs-Tester's Content Diagram



CNNs-Tester's Use Case Diagram

Desktop Application CNNs-Tester



CNNs-Tester Starting frame

CNNs-Tester : Experimental Results

Exp	Accuracy	Precision	Recall	F1 Score	Epochs	Iterations	Learning Rate
1	0.0798	0.1593	0.1022	0.1245	1000	1	0.1
2	0.3417	0.2988	0.3535	0.3239	10	1	0.1
3	0.3786	0.3699	0.4117	**0.3897**	5	1	0.1
4	0.3119	0.3842	0.344	0.363	3	1	0.1

SIMPLIcity Image-Database results

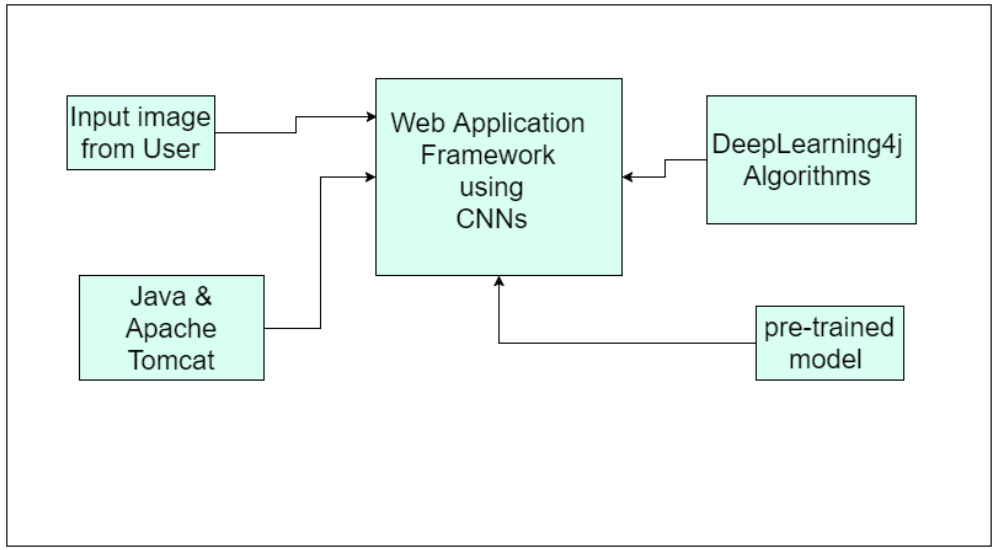
Exp	Accuracy	Precision	Recall	F1 Score	Epochs	Iterations	Learning Rate
1	0.2132	0.2876	0.102	0.1506	10	10	0.1
2	0.149	0.1666	0.0947	0.1207	10	1	0.1
3	0.1833	0.1242	0.0658	**0.**086	10	100	0.1
4	0.2426	0.3049	0.1914	**0.2352**	20	1	0.1
5	0.2352	0.3115	0.1883	0.2347	30	1	0.1

NEC Animal Image-Database results

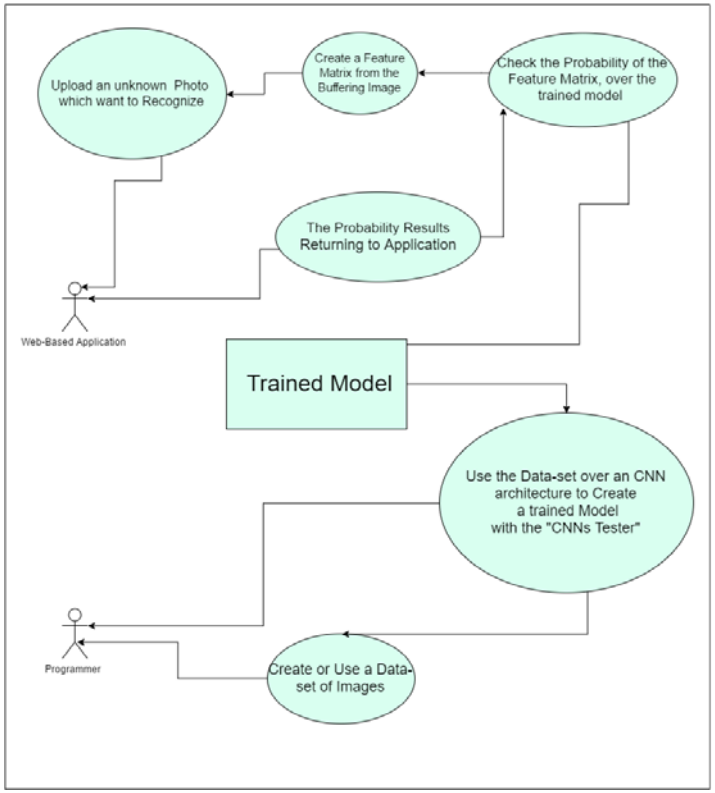
Exp	Accuracy	Precision	Recall	F1 Score	Epochs	Iterations	Learning Rate
1	0.3639	0.4322	0.3236	0.3701	10	5	0.1
2	0.2891	0.5478	0.3181	**0.4025**	5	1	0.1
3	0.2463	0.3196	0.2781	0.2974	20	1	0.1
4	0.335	0.3732	0.3272	0.3487	30	1	0.1
5	0.1007	0.1007	0.1007	0.1007	50	1	0.1

Rabbit Image-Database results

Web-Application PaternF

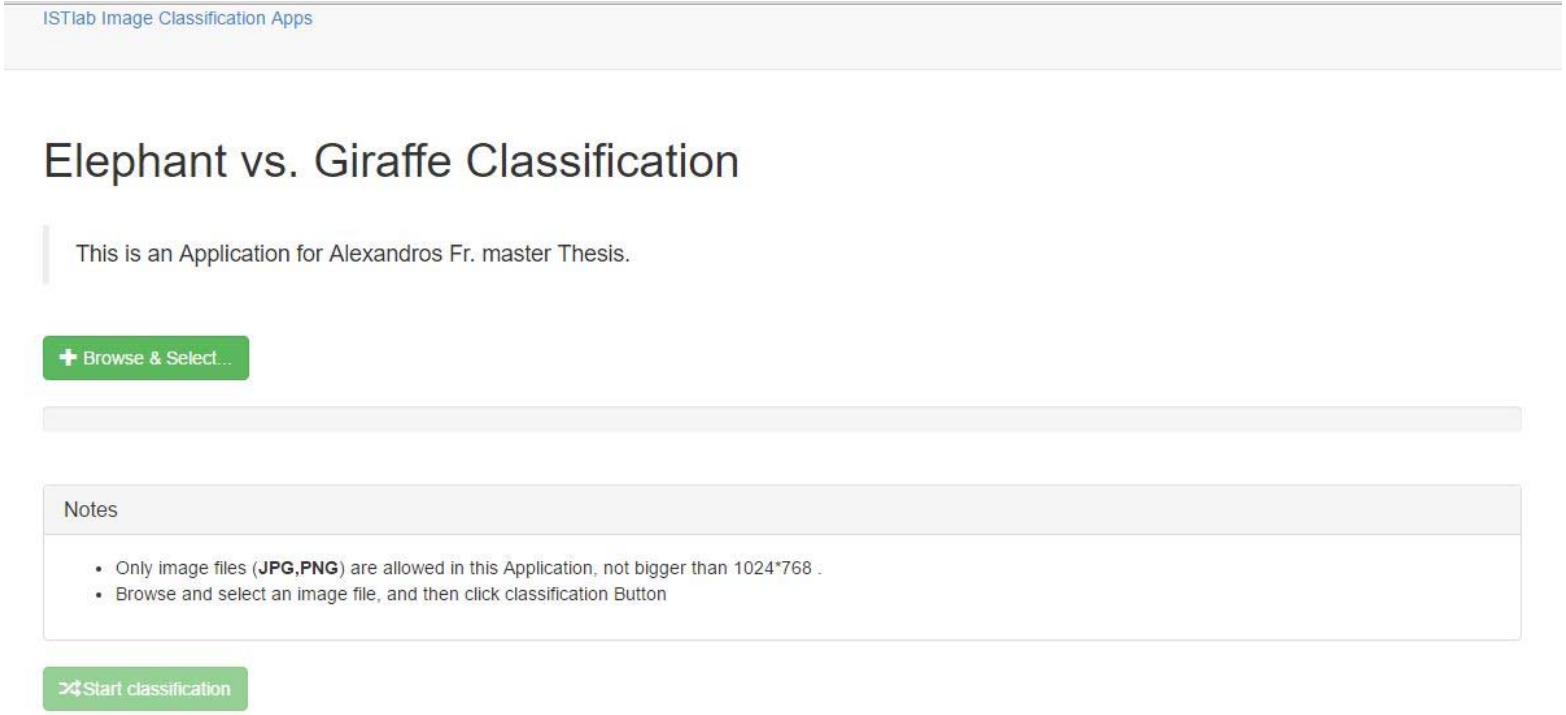


Web-Application's Content Diagram



Web-Application's Use Case Diagram

Web-Application PaternF



CNNs PaternF's Starting frame

Contribution & Future Work

Contribution

- New applications for Image Classification, consider also as a framework
- Complete training and testing implementation
- GUI for Deeplearning4j
- Easy to use from non experts
- Easy to implement (due to design)
- Systems compatibility (due to Java)

Future work

- Improvement of Existing Work
  - Java Desktop Application (CNNs Tester)
  - Web-Application (PaternF)
- A step Further in the usage of Deep Learning
  - Platform for multiple deep learning algorithms
  - Deep Learning for other areas than Computer Vison
  - Deep Learning project for financial issues
  - Art improvements, through Computer Vison & Deep Learning

Thank you for your time

Questions?