

One class classifier development for PAP smear image screening

CHALLENGES

Health, demographic change and wellbeing

The Industrial Problem

The investigations are expected to lead to a successful improvement of the accuracy of Convolutional Neural Networks regarding the identification of diseased cells in the digitalized smear test.

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Here we list the fields of expertise of the members of the research team as medical image processing, machine learning, graph theory, ensemble systems, neural networks

SightSpot Network

Ltd



IT company with great experience in the field of application development.

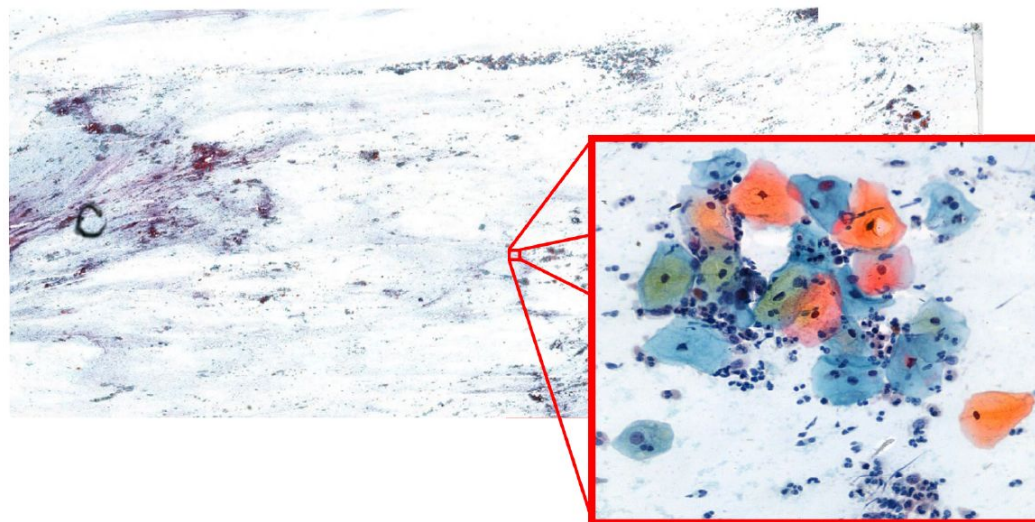
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Challenges & Goals

- Can we use a CNN to classify the cells?
- Can we address the unbalanced dataset problem with generative networks?
- Is there a possibility to create a system that can generate appropriate synthetic images?
- Can we improve the accuracy of a CNN regarding the diseased cells?
- Can we use a specific cost function in order to improve the performance of a neural network in our case?

medical
sector

Health,
demographic
change and
wellbeing

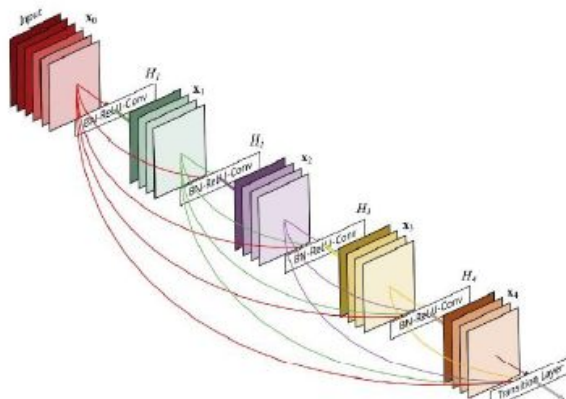


Example of a digitalized smear

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Mathematical and computational methods and techniques applied

- We investigated the available CNN architectures and chose one appropriate for the task at hand.
- We examined the use of autoencoders as well as variational autoencoders for the generation of synthetic data
- We worked out a hybrid network using a combination of variational autoencoders and classification networks
- We developed a system that significantly improved the performance of CNN regarding diseased cells



Architecture of the CNN

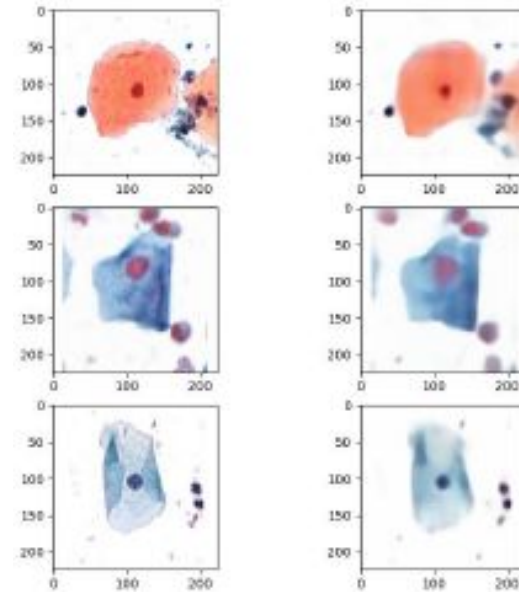
	Combined performance	F1-Score	Recall
Original dataset	0,59	0,88	0,32
Balanced Dataset 1	0,81	0,72	0,91
Balanced Dataset 2	0,78	0,71	0,86

Performances of CNN with different datasets

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Results & Benefits to the company

- We developed a convolutional neural network based algorithm with modern architecture that is able to perform cell classification
- We proposed a system that is able to generate synthetic images using generative deep learning techniques
- We considered a hybrid variational autoencoder system in order to solve the unbalanced dataset problem
- The developed system is an important milestone regarding the goals of the industrial partner



Example of generated synthetic images

We developed a system that solves the unbalanced dataset problem and improves the performance of the CNN used for cell classification