

# **SIGNIFICANCE OF DICTIONARY FOR SPARSE CODING BASED FACE RECOGNITION**

*A THESIS*

*submitted by*

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*for the award of the degree*

*of*

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**(by Research)**



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*...that is why it is so important to let certain things go. To release them. To cut loose. People need to understand that no one is playing with marked cards; sometimes we win and sometimes we lose. Don't expect to get anything back, don't expect recognition for your efforts, don't expect your genius to be discovered or your love to be understood. Complete the circle, then leave. Not out of pride, inability or arrogance, but simply because whatever it is no longer fits in your life. Close the door, change the record, clean the house, get rid of the dust. Stop being who you were and become who you are....*

PAULO COELHO, *The Zahir*

*To my Granny  
and to my Kerala*

## **DECLARATION**

I hereby declare that the entire work embodied in this thesis is the result of investigations carried out by me in the **School of Computing and Electrical Engineering**, Indian Institute of Technology Mandi, under the supervision of **Dr. Anil Kumar Sao**, and that it has not been submitted elsewhere for any degree or diploma. In keeping with the general practice, due acknowledgements have been made wherever the work described is based on finding of other investigators.

Mandi, 175 001

**Shejin T**

## **THESIS CERTIFICATE**

This is to certify that the thesis titled **SIGNIFICANCE OF DICTIONARY FOR SPARSE CODING BASED FACE RECOGNITION**, submitted by **Shejin T**, to the Indian Institute of Technology, Mandi, for the award of the degree of **Master of Science (by Research)**, is a bonafide record of the research work done by him under my supervision. The contents of this thesis, in full or in parts, have not been submitted to any other institute or university for the award of any degree or diploma.

Mandi, 175 001

**Dr. Anil Kumar Sao**  
(Guide)

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*Shejin T*



# ABSTRACT

**Keywords:** *Dictionary, sparse coding based face recognition, weighted decomposition of face, pose detection, pose invariant face recognition, distant face recognition.*

Sparse coding based face recognition makes use of a dictionary having training face images as its columns. A test face image is represented as a sparse linear combination of these training images. This thesis establishes the significance of dictionary for sparse coding based face recognition, which is relatively less explored in the related literature. In this work, we propose a new dictionary which is named as weighted decomposition of face (WD Face) dictionary. This dictionary is derived based on the assumption that a face image can be decomposed into three components as, (i) a common component, (ii) a noise component, and (iii) a component which contains the subject specific unique information of the person. WD Face dictionary is generated by giving higher weightage to the subject specific components, which play a crucial role in identifying one person from the other. It also addresses the requirement of large number of training face images. The effect of illumination in computation of WD Face image is reduced using edginess based representation of image, which is derived using one-dimensional (1-D) processing of image. 1-D processing of image provides multiple partial edge evidences, which are combined to enhance the face recognition performance. Moreover, we experimentally show that the proposed dictionary ensures sparse representation of test image as a linear combination of training images even when the number of training images is small.

Further, WD Face dictionary is incorporated to address the problem of pose variation in face recognition with the help of a two stage approach. The first stage makes use of a pose detection technique based on sparse coding to approximate the pose of an incoming test image and classify it in to one of the target pose classes. In the second stage, a WD Face dictionary is chosen corresponding to the detected pose and the identity of the person is obtained using sparse coding based face recognition with the help of the chosen dictionary. Moreover, the problem of distant face recognition is addressed with the help of image super resolution and the proposed WD Face dictionary. The missing facial features from a test image are restored using image super resolution. Then, the identity of this image is obtained

by sparse coding based face recognition, which incorporates WD Face dictionary derived from high resolution training images.

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