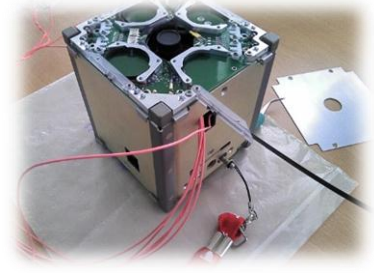


Document Analysis and Machine Learning Research in Pakistan

Dr Khurram Khurshid

Professor, Institute of Space Technology, Islamabad
Director, Artificial Intelligence Cell, SPD

*One of the Founding members of PPRS



- Established in 2002
- Ranked 4th in Engineering Univs in Pakistan
- In-house satellite design & development
 - iCube-1 – Launched in 2013
 - iCube-2 – 4th quarter of 2020

iVISION



Dr. Khurram Khurshid

*Document Analysis, Hyper-spectral
Image analysis, Pattern Recognition*



Dr. Sadia Shakil

*Biomedical Image Analysis,
Neuroscience*



Dr. Farrukh Bhatti

*Machine Learning, Internet of
Things, Video Analysis*



Dr. Sajid Ghuffar

*Remote Sensing, Photogrammetry,
Machine Learning*



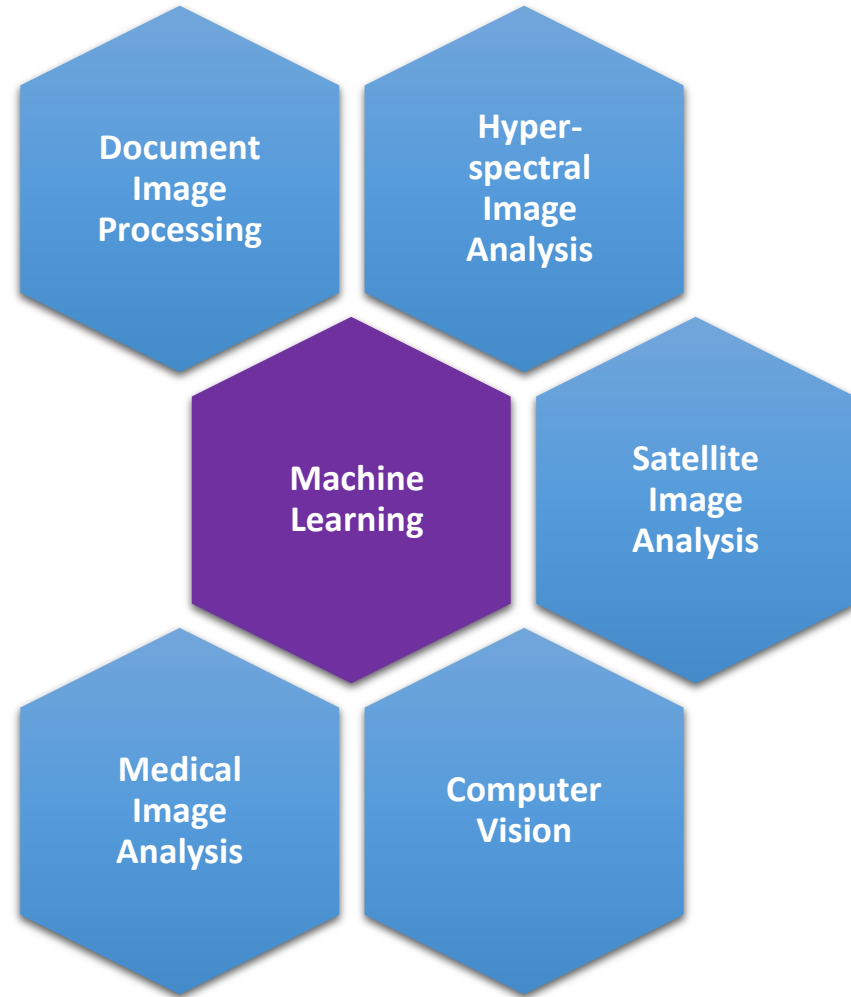
M. Jaleed Khan

*Deep Learning, Hyperspectral Image
Analysis, Computer Vision*



Dr. Abdur Rahman

*Image Processing, Sparse Signal
Processing, ML*



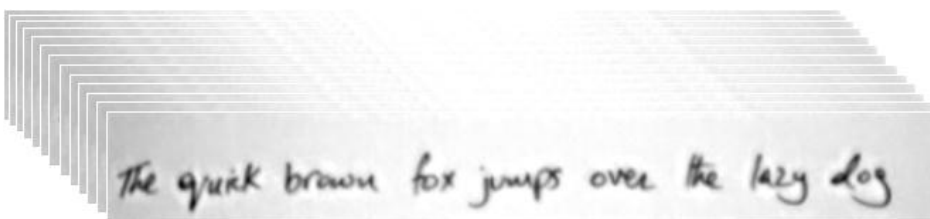
RESEARCH PROJECTS

Document Forgery Detection using Hyperspectral Image Analysis

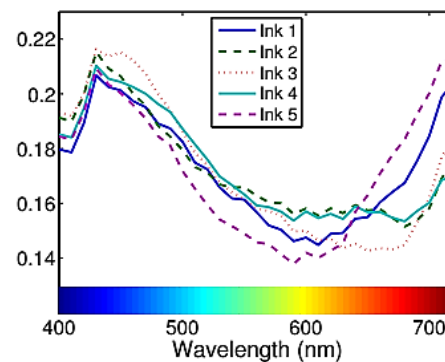
DOCUMENT



HYPERSPPECTRAL IMAGE



INK ANALYSIS



The quick brown fox jumps over the lazy dog.

- A Spatio-Spectral Hybrid Convolutional Architecture for Hyperspectral Document Authentication, ICDAR 2019
- Automated Forgery Detection in Multispectral Document Images using Fuzzy Clustering, DAS 2018
- Towards Automated Ink Mismatch Detection in Hyperspectral Document Images, ICDAR 2017

Writer Identification using Hyper-spectral Image Analysis

S. No.	Combination Name	Number of Subjects	Mixing Ratio
1.	I	2	1:1
2.	II	2	1:4
3.	III	2	1:8
4.	IV	2	1:16
5.	V	2	1:32
6.	VI	3	1:1:1
7.	VII	4	1:1:1:1
8.	VIII	5	1:1:1:1:1
9.	IX	6	1:1:1:1:1:1
10.	X	7	1:1:1:1:1:1:1

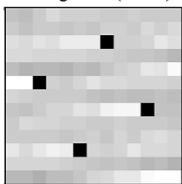
Single Pixel (Black)



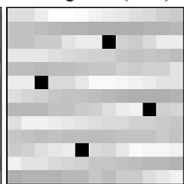
Single Pixel (Blue)



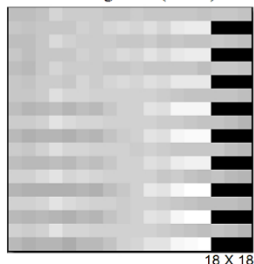
4-Neighbors (Black)



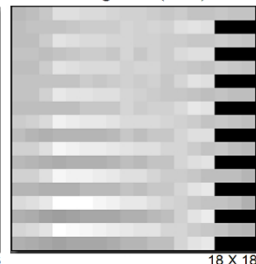
4-Neighbors (Blue)



8-Neighbors (Black)



8-Neighbors (Blue)

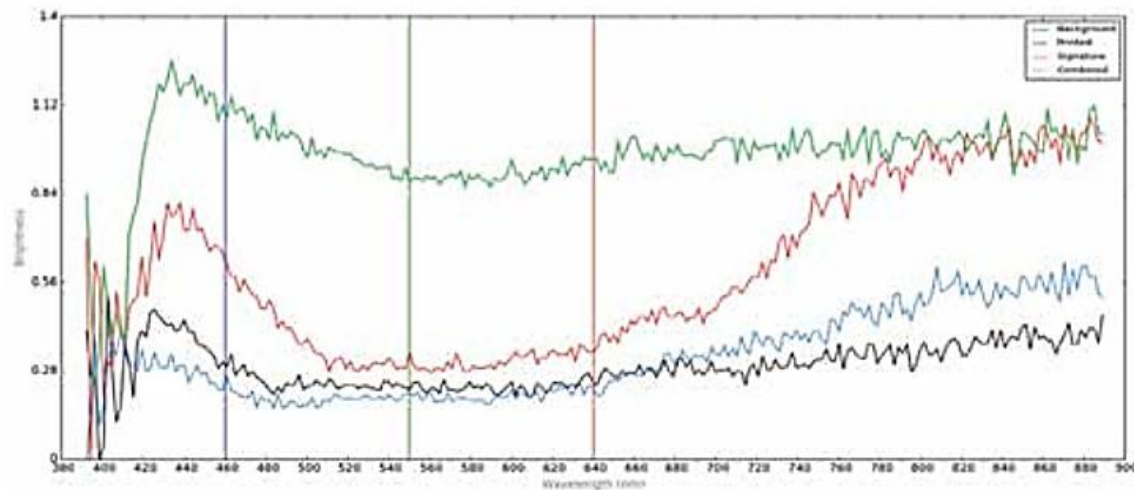
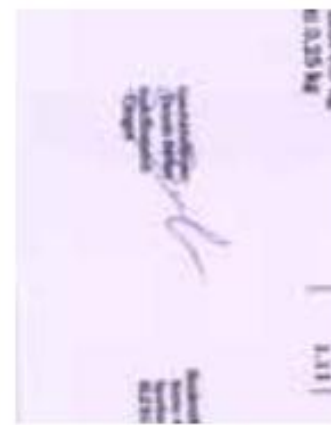


Example of spectral response of a text pixel and its neighboring pixels organized in three spatio-spectral image formats

Combination (Subjects)	Image Type	Images
II (2,3)	Ground Truth	The quick brown fox jumps over the lazy dog
	Result	The quick brown fox jumps over the lazy dog
VI (2,3,4)	Ground Truth	The quick brown fox jumps over the lazy dog
	Result	The quick brown fox jumps over the lazy dog
VII (2,3,4,5)	Ground Truth	The quick brown fox jumps over the lazy dog
	Result	The quick brown fox jumps over the lazy dog
VIII (2,3,4,5,6)	Ground Truth	The quick brown fox jumps over the lazy dog
	Result	The quick brown fox jumps over the lazy dog
IX (2,3,4,5,6,7)	Ground Truth	The quick brown fox jumps over the lazy dog
	Result	The quick brown fox jumps over the lazy dog
X (1,2,3,4,5,6,7)	Ground Truth	The quick brown fox jumps over the lazy dog
	Result	The quick brown fox jumps over the lazy dog

Signature Extraction and Verification using Hyper-spectral Image Analysis

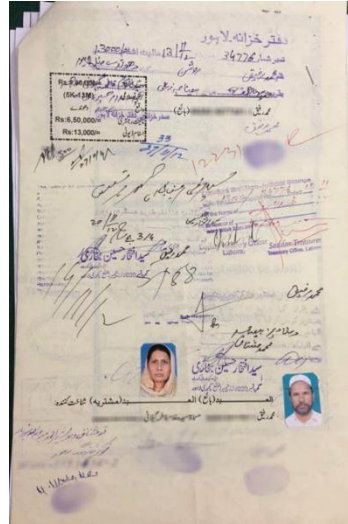
NUMMER	Betrag	Faktor
P3191	33,60	1,00
P3214	150,00	1,00
A5	10,72	2,30
231	18,76	2,30
405	1,40	2,30
403	4,53	2,30
404	5,81	2,30
224,82 EUR Rechnungsbetrag		
steuerfrei nach § 4 UStG.		
10 Tage nach Fälligkeit und Zugang der Rechnung		



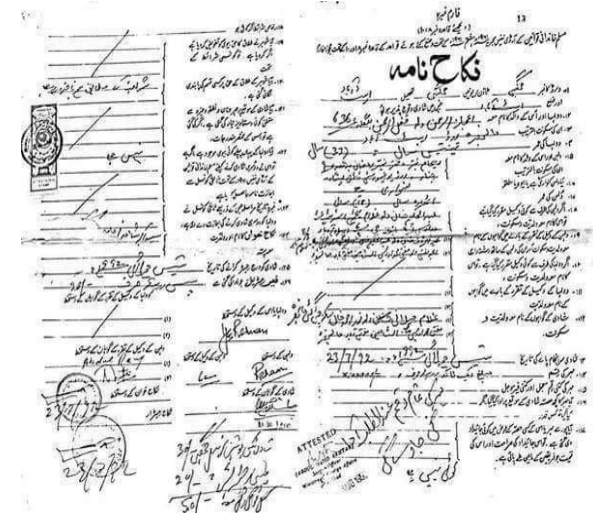
Perspective Hyper-spectral Document Image Applications



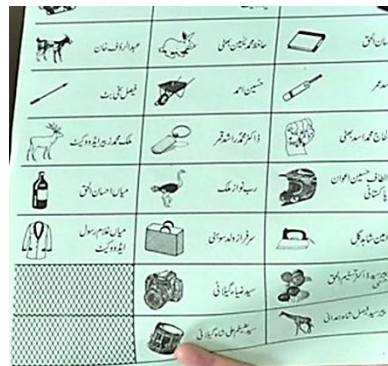
WASIYYAT FORM



PROPERTY DOCUMENTS

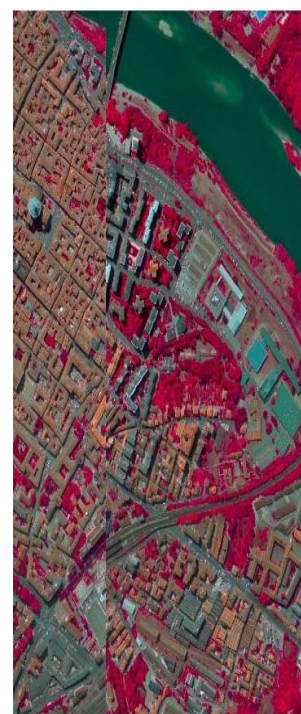
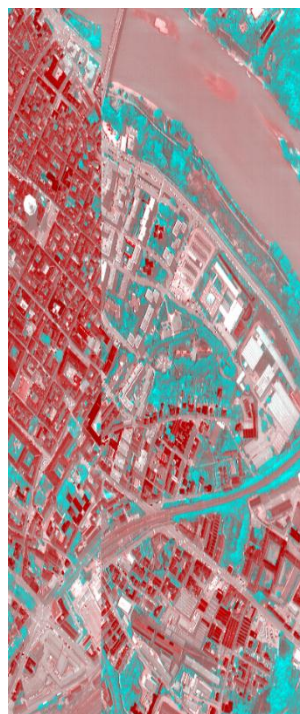
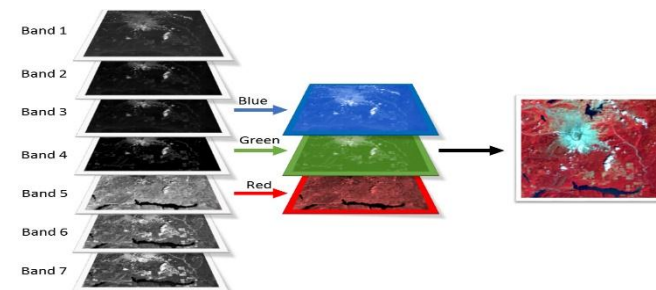
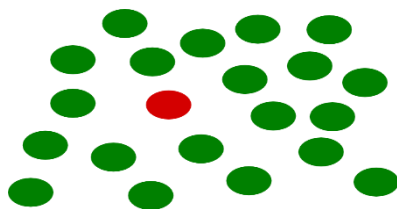


NIKAH NAMA



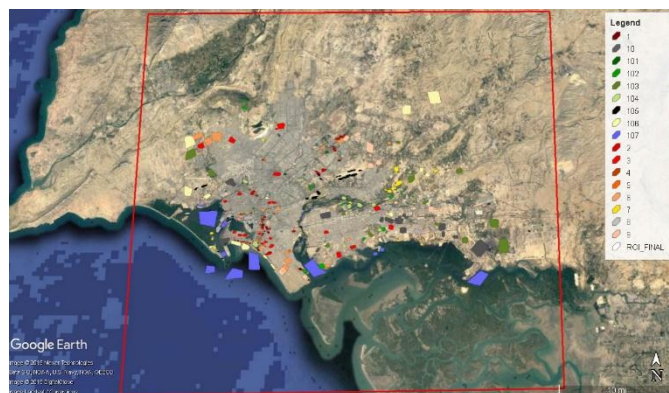
BIOMETRIC VERIFICATION OF BALLOT PAPERS

Saliency based Visualization & Segmentation of Hyperspectral Satellite Images

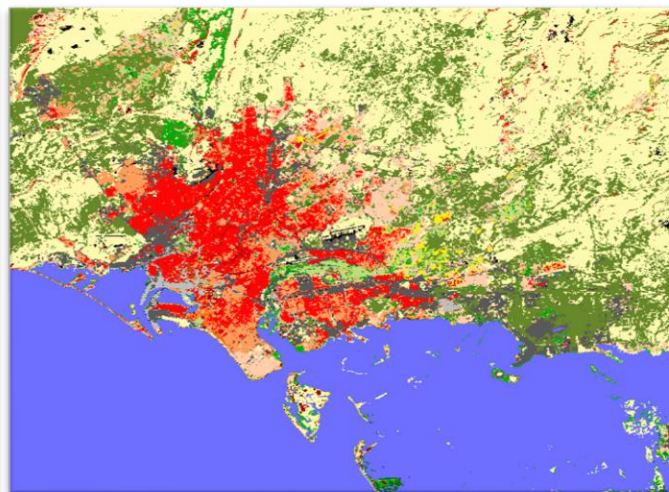


- Optimized Class-Separability in HyperSpectral Images, IGARSS 2016
- Saliency based Visualization of Hyper-spectral Images, IGARSS 2015

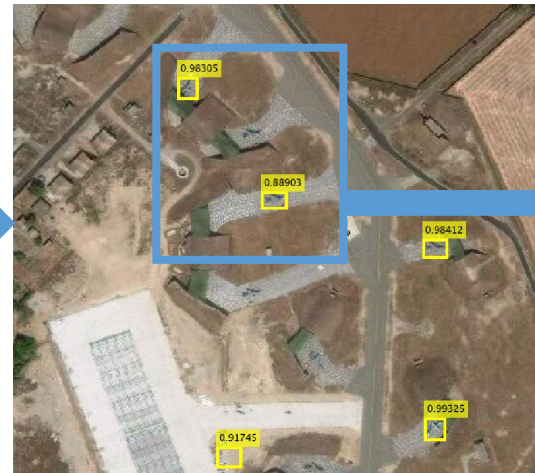
Local Climate Zone Classification



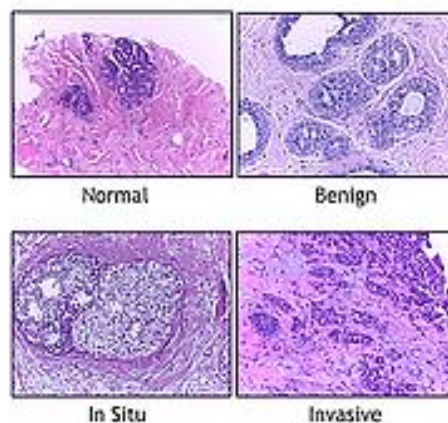
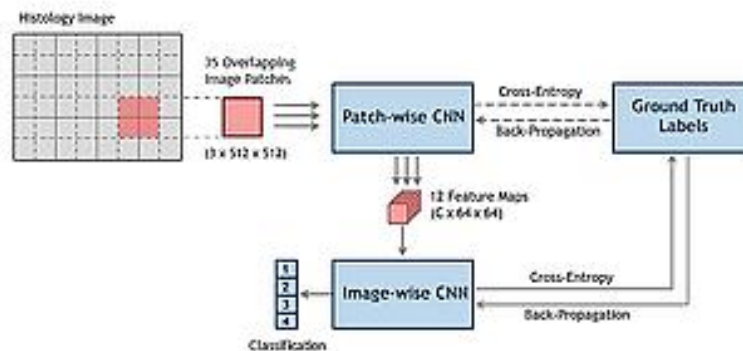
Urban Local Climate Zones	LCZ	Example	Rural Climate Zones	LCZ	Example
	1 Compact high-rise			11 A Dense trees	
	2 Compact midrise			12 B Scattered trees	
	3 Compact low-rise			13 C Bush and Scrub	
	4 Open high-rise			14 D Low plants	
	5 Open midrise			15 E Bare rock or paved	
	6 Open low-rise			16 F Bare soil or sand	
	7 Lightweight low-rise			17 G Water	
	8 Large low-rise				
	9 Sparsely built				
	10 Heavy industry				



Aircrafts Detection in Satellite Images



Breast Cancer Detection in Histopathology Images



Video analysis for heart rate estimation (video scope)



(a) Original Video Frames



(b) Magnified Color Variations

- Scope of Video Magnification in Human Pulse Rate Estimation, CMVIT 2017

PPRS

Share. Collaborate.

It is amazing what you can accomplish
if you do not care who gets the credit.
(Harry S. Truman)