Wavelets and CNN Workshop

#	Module	Topics	URL			
1	Theory of Wavelets and Filter banks	Lecture by Prof. Vikram Gadre				
	Explore and DIY Discrete Wavelet Transforms (50 mins)	Explore DWT 1D, 2D and perfect reconstruction using available libraries. Identify challenges for building transforms for use in backpropagation CNNs. Suggest possible solutions.	https://forms.gle/bfiyBgrfuPUGWT6P6	Python DWT & IDWT (1D & 2D)	https://pywavelets.readthedocs.io/en/latest/index.html	
				MATLAB DWT1D	https://www.mathworks.com/help/wavelet/ref/dwt.html	
				MATLAB IDWT1D	https://www.mathworks.com/help/wavelet/ref/idwt.html	
				MATLAB DWT2D	https://www.mathworks.com/help/wavelet/ref/dwt2.html	
				MATLAB IDWT2D	https://www.mathworks.com/help/wavelet/ref/idwt2.html	

Though the following content is implemeted in TensorFlow, however understanding the mathematics in the content below will allow us to realize separable D-dimensional DWT and IDWT independent of any software platform.

#	Module	Topics	URL			
2	DWT basics (50 mins)	TFDWT arxiv paper	https://arxiv.org/abs/2504.04168			
		TFDWT PyPI package	https://pypi.org/project/TFDWT/			
		DWT 1D and perfect reconstruction	DWTIDWTTutorial1.ipynb			
		DWT 2D and perfect reconstruction	https://colab.research.google.com/drive/12sReAqzjDAOg4tZEuYxTO9riF1g2Yqpw?usp=sharing			
		Sample brain image	https://drive.google.com/file/d/1pWLcCZLFL07EfCwFdfmfTq1g0JgWnMFJ/view?usp=sharing			
		DWT layers for CNN	https://github.com/kkt-ee/TFDWT/blob/main/Tutorials/DWT_IDWT_Layers_Demo.ipynb			
			https://github.com/kkt-ee/TFDWT/blob/main/Tutorials/DWT_Level1_Perfect_Reconstruction_1D_2D_3D_Filterbanks.ipynb			
3	MEDCNN for binary segmentation (50 mins)	ICASSP'25 paper	https://doi.org/10.1109/ICASSP49660.2025.10890832			
		PyPI package	https://pypi.org/project/MEDCNN/			
		Notebook - binary segmentation with CNN (U-Net)	https://github.com/kkt-ee/MEDCNN/blob/main/DemoTrainingPipelines/ControlUnet2D_ColabPipelinePIP.ipynb			
		Notebook - Binary segmentation with MEDCNN	https://github.com/kkt-ee/MEDCNN/blob/main/DemoTrainingPipelines/G2D_ColabPipelinePIP.ipynb			
		~~Curated data for segmentation~~	https://drive.google.com/drive/folders/14osnrfB9ms_NNYITKVv-JuCN_8Y2r_Tn?usp=drive_link			
4	Feedback form	Please fill the feedback form	https://forms.gle/mhxpFdWthJvHCAoYA			

Workshop conducted at VNRVJIET,Hyderabad at 10/04/2025

Lab module 2	*Multiresolution signal processing*
Lab module 3	*Deep learning unified with multiresolution signal processing*
Theory instructor :	Prof. Vikram Gadre, EE, Indian Institute of Technology Bombay
Lab instructor :	Kishore Tarafdar, PhD student, EE, Indian Institute of Technology Bombay