Contents

Contents		3
Introduction		7
Embedded Class Label	S	9
Code for Learnin	ng Embedded Labels	13
Classifying Case	es	21
Class-Condition	al Generative Sampling	24
Signal Preprocessing		29
Minimal Transfo	ormation	31
Displayin	ng Differenced Generative Samples.	32
	on	
Fourier Coefficie	ents in a Moving Window	37
	5	
Period, W	Vidth, and Lag	44
	Morlet Wavelets	
Image Preprocessing		53
	nsform in Two Dimensions	
Data Win	idows in Two Dimensions	60
Code for	the Fourier Transform of an Image.	64
	ng Generative Samples of Fourier Tra	
Autoencoding		73
_	ics of Feedforward Networks	
Greedy Training	g with Autoencoders	79
	olex Numbers	
	Product Computation in the Comple	
	Value Decomposition in the Comple	

4 Contents

Activation in the Complex Domain	91
Derivatives of the Activation Function	96
The Logistic Activation Function and its Derivative	99
Computing the Gradient	100
Pure Real and SoftMax Output Errors	105
Gradient of the Hidden Layer Weights	108
Code for Gradient Computation	112
Evaluating the Entire network and Derivatives	112
Computing the Gradient	116
Multithreading Gradient Computation	123
CUDA Gradient Computation	131
The Overall Algorithm	131
Device Initialization	139
Copying Weights from Host to Device	145
Activation and its Derivatives	148
Output Activation	153
SoftMax Modification of Outputs	
Output Delta	156
Delta for SoftMax Outputs	158
Output Gradient	159
Gradient of the First Hidden Layer	161
Gradient of a Subsequent Hidden Layer	163
Mean Squared Error	164
The Log Likelihood Criterion for Classification	167
An Analysis	168
Deep Operating Manual	171
Menu Options	172
File Menu Options	172
Test Menu Options	174
Display Menu Options	
Read a Database	
Read a Series (Simple)	
Read a Series (Path)	

Contents 5

Read a Series (Fourier)	
Read a Series (Morlet)	
Read MNIST Image	
Read MNIST Image (Fourier)	
Read MNIST Labels	
Write Activation File	
Clear All Data	
Model Architecture	
Database Inputs and Targets	
RBM Training Params	
Supervised Training Params	
Autoencoding Training Params	
Train	
Test	
Analyze	
Receptive Field	
Generative Sample	
*	d Model 223
<u> </u>	s
The DEEP.LOG File	
Predictive Performance Me	asures
ndex	239