

Building Features from Image Data in Microsoft Azure

EXPLORING COMPUTER VISION ON AZURE



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Overview

Exploring the concept of computer vision

Understanding computer vision use cases

Reviewing approaches to computer vision solutions

Examining Azure computer vision capabilities

Configuring a working environment for computer vision experimentation

Introduction to Computer Vision

Computer Vision

Utilizing computers to extract discernible information from an image or video. In most cases, it is leveraged to replace a manual process that utilizes human vision.

Use Cases

Image classification

Localization

Object detection

Facial recognition

Object segmentation

Metadata extraction

Object tracking











R:201 G:181 B:144	R:171 G:144 B:113	R:141 G:110 B: 81	R:114 G: 80 B: 58	R: 98 G: 63 B: 45	R: 87 G: 53 B: 42	R: 80 G: 49 B: 41
R:226 G:211 B:180	R:200 G:179 B:148	R:173 G:148 B:117	R:144 G:114 B: 87	R:123 G: 90 B: 67	R:105 G: 71 B: 54	R: 90 G: 57 B: 44
R:243 G:234 B:209	R:224 G:212 B:185	R:205 G:189 B:154	R:177 G:152 B:122	R:152 G:123 B: 94	R:128 G: 94 B: 71	R:105 G: 67 B: 50
R:252 G:250 B:231	R:242 G:237 B:215	R:233 G:224 B:189	R:208 G:190 B:157	R:181 G:156 B:125	R:153 G:122 B: 94	R:125 G: 86 B: 65
R:255 G:254 B:239	R:255 G:255 B:234	R:255 G:255 B:218	R:237 G:225 B:191	R:211 G:192 B:159	R:182 G:154 B:125	R:152 G:117 B: 91
R:249 G:248 B:229	R:255 G:255 B:238	R:255 G:254 B:234	R:255 G:251 B:218	R:235 G:222 B:192	R:209 G:188 B:161	R:181 G:154 B:125





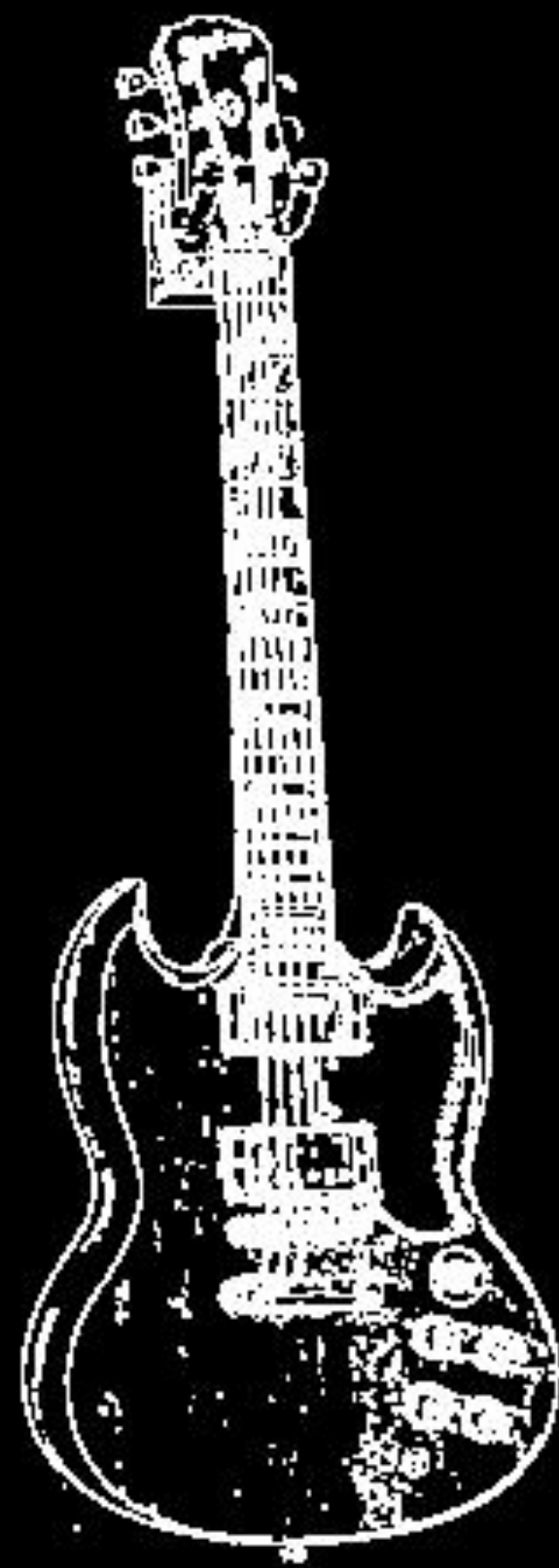
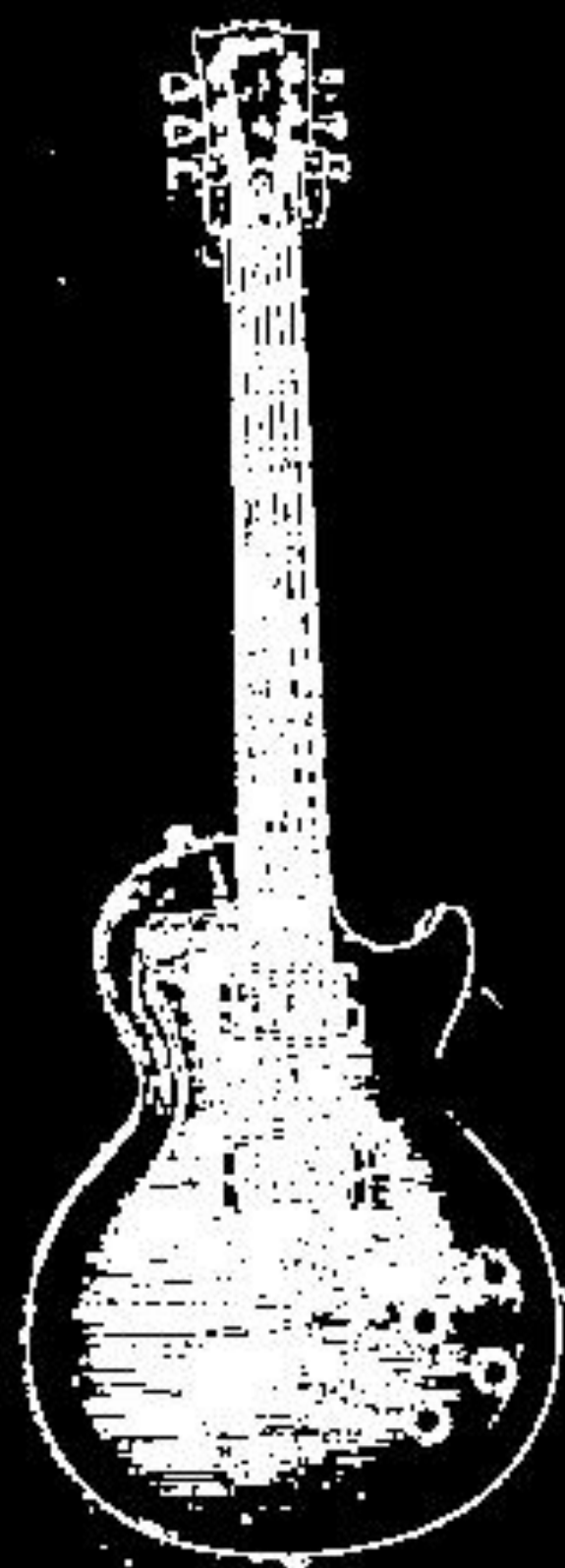
219	184	148	111	80	63	50	42	36
242	217	187	152	120	96	77	60	48
248	240	222	194	164	138	113	88	66
242	249	245	232	209	184	154	122	92
219	242	252	252	241	222	195	160	124
185	213	234	246	250	242	225	198	165
142	168	193	217	233	243	244	231	204
106	125	150	176	204	229	246	250	236

“... a **feature** is an individual measurable property or characteristic of a phenomenon being observed.”

Wikipedia



219	184	148	111	80	63	50	42	36
242	217	187	152	120	96	77	60	48
248	240	222	194	164	138	113	88	66
242	249	245	232	209	184	154	122	92
219	242	252	252	241	222	195	160	124
185	213	234	246	250	242	225	198	165
142	168	193	217	233	243	244	231	204
106	125	150	176	204	229	246	250	236



guitar 98%



guitar 96%



guitar 97%



Summary

Computer vision is mainly focused on automating human perception

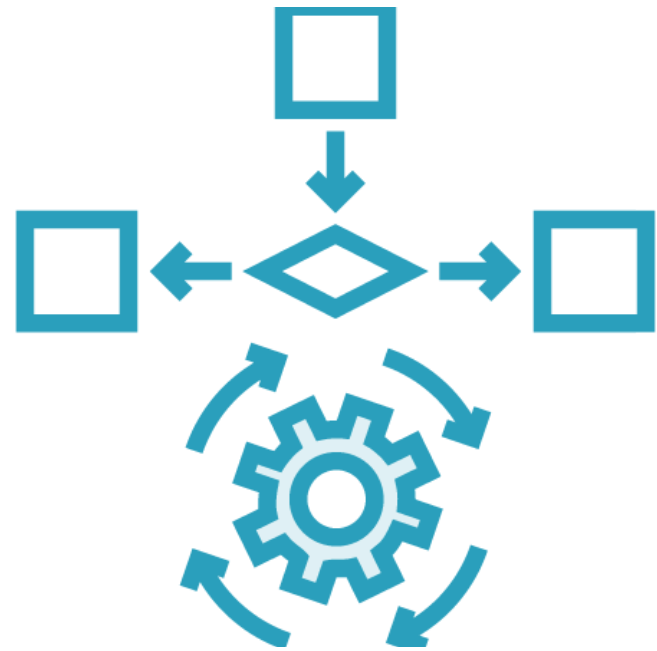
Computers see images as channels of pixel data

To perceive data from an image, we must look for specific features

The edge of a guitar is a type of feature that we extract data on

Approaches to Computer Vision

Types of Computer Vision Approaches



Non-learning

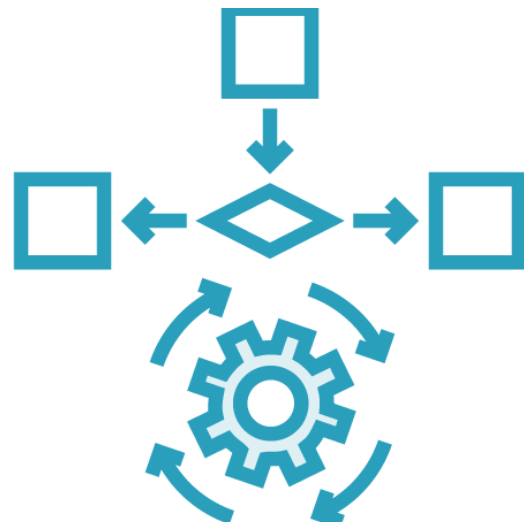
Configurable algorithms



Learning

Neural networks

Non-learning Approach



Utilizes configurable algorithms to extract features

Does not require excessive computing power (in most cases)

Beneficial for matching of the same image

May be used in tandem with a learning based approach

Feature Detector

Algorithm to navigate an image and determine if a specific pre-defined feature exists at a specific point within the image.

Types of Image Feature Detectors

Edge Detection

Utilized to find the edges of objects included within the image

Corner Detection

Utilized to detect the corners of objects within the image

Blob Detection

Utilized to detect object regions within the image

Feature Descriptor

Algorithm that analyzes an image and returns a collection of feature vectors that can be compared against for analysis in other images. In most cases this can find recurrences of the feature irrespective of scale or rotation.

Function Descriptors

SIFT

Scaled Invariant
Feature Transform

HOG

Histogram of Ordered
Gradients

FAST

Features from
Accelerated Segment
Test

BRIEF

Binary Robust
Independent
Elementary Features

ORB

Oriented FAST and
Rotated BRIEF

SURF

Speeded Up Robust
Features

Learning Approach



Utilizes a neural network approach to learn based on training data

Requires a large amount of data for supervised learning

Requires additional compute power either through CPU or GPU

Can be used in coordination with a non-learning based approach

Neural Network

Computing system that is modeled after the way that human brains function in which the system can **learn** to perform tasks based on example data without configuring a specific set of tasks to follow.

Types of Neural Networks

MLP

Multi-layer Perceptron

RNN

Recurrent Neural
Network

FF

Feed Forward

LSTM

Long/Short Term
Memory

RBF

Radial Basis Function
Network

CNN

Convolutional Neural
Network

Summary

Learning and non-learning approaches are not mutually exclusive

There are differing compute requirements for the two approaches

Specific use cases can dictate one approach over another

In building a real solution, you will likely experiment with multiple approaches

Azure Services for Computer Vision

Categories of Services

Pre-trained

Services that have pre-trained models for specific tasks

Custom

Services that allow for you to create models to meet custom use cases

Azure Cognitive Services

Decision

Recommendations for
decision-making

Speech

Services for speech to text,
translation, and verification

Language

Natural language
processing and analysis

Search

Integrate Bing search into
analysis

Vision

Service for specific
computer vision use cases

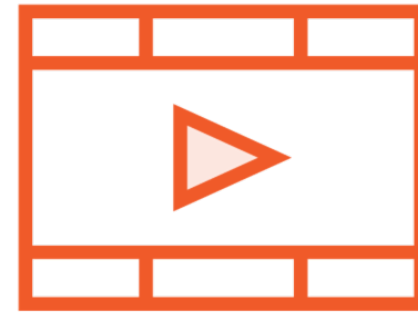
Azure Cognitive Services - Vision



Computer Vision



Face



Video Indexer



Custom Vision

Custom Implementations

Machine Learning Service

Build, train, and deploy models without managing infrastructure in a defined workflow

Data Science Virtual Machine

Build, train, and deploy models on a pre-configured virtual machine that you manage

Azure Data Science Virtual Machine



Windows versions for Windows 2012 and Windows 2016

Linux versions for Ubuntu and CentOS

Comes with common frameworks and tools pre-installed and configured

Includes development resources including IDE's and command line tools

Integrates with Azure Machine Learning

Working Environment

We'll be using an Azure DSVM for Ubuntu

Leveraging Jupyter notebooks for our work

There are many features of the DSVM that we won't be leveraging in this course

What we setup in the next clip will be the baseline for the following modules

Launching a Data Science Virtual Machine

Demo

Launch an Azure Data Science Virtual Machine (DSVM) instance from the Azure Marketplace

Connect to the DSVM instance

Review available Conda environments

Test a Jupyter notebook running on the DSVM instance

Decommission DSVM instance

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