

Imagery Analysis in ArcGIS® Pro

STUDENT EDITION

Copyright © 2020–2025 Esri

All rights reserved.

Course version 6.0. Version release date August 2025.

Printed in the United States of America.

The information contained in this document is the exclusive property of Esri. This work is protected under United States copyright law and other international copyright treaties and conventions. No part of this work may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, or by any information storage or retrieval system, except as expressly permitted in writing by Esri. All requests should be sent to Attention: Director, Contracts and Legal, Esri, 380 New York Street, Redlands, CA 92373-8100, USA.

Export Notice: Use of these Materials is subject to U.S. export control laws and regulations including the U.S. Department of Commerce Export Administration Regulations (EAR). Diversion of these Materials contrary to U.S. law is prohibited.

The information contained in this document is subject to change without notice.

Commercial Training Course Agreement Terms: The Training Course and any software, documentation, course materials or data delivered with the Training Course is subject to the terms of the Master Agreement for Products and Services found at the following website: esri.com/TrainingTerms. The license rights in the Master Agreement strictly govern Licensee's use, reproduction, or disclosure of the software, documentation, course materials and data. Training Course students may use the course materials for their personal use and may not copy or redistribute for any purpose. Contractor/Manufacturer is Esri, 380 New York Street, Redlands, CA 92373-8100, USA.

Esri Marks: Esri marks and product names mentioned herein are subject to the terms of use found at the following website: esri.com/EsriMarks.

Other companies and products or services mentioned herein may be trademarks, service marks, or registered marks of their respective mark owners.

Table of Contents

Esri resources for your organization

Course introduction

Course introduction

Course goals

Installing the course data

Training Services account credentials

Icons used in this workbook

1 Raster functions

Lesson introduction

Manipulating raster data

What are raster functions?

Benefits of raster functions

Consider raster function parameters

Types of raster functions

Exercise 1: Explore raster functions

- Create a new ArcGIS Pro project

- Examine a raster

- Apply the Greater Than function

- Apply the Slope function

- Apply the Aspect function

Lesson review

Answers to lesson 1 questions

2 Raster function templates

Lesson introduction

What are raster function templates?

Raster function template components

Evaluate a raster function template

Exercise 2: Create a raster function template

- Create the raster function template

- Build the first raster function
- Build the second raster function
- Combine the raster functions
- Apply the function template
- Modify the raster function template
- Apply the raster function template
- Challenge: Add Aspect range to the calculation

Raster functions used in raster products

Benefits of using raster function templates

Lesson review

Answers to lesson 2 questions

3 Raster-based change detection

- Lesson introduction
- Change detection types
- Choosing types of change detection
- Raster-based change detection workflow
- Preprocessing methods for change detection
- Exercise 3: Calculate change between two raster datasets
 - Evaluate rasters
 - Preprocess input rasters
 - Calculate change with the Change Detection Wizard
 - Identify meaningful change
 - Classify the analysis results
- Lesson review
- Answers to lesson 3 questions

4 Image classification techniques

- Lesson introduction
- Defining image classification
- Describing image classification outputs
- Image classification types
- Image classification methods
- Choosing image classification techniques
- Lesson review

Answers to lesson 4 questions

5 Classification workflows

Lesson introduction

Unsupervised image classification workflow

Exercise 5: Use the unsupervised image classification workflow

- Add input data

- Prepare the surface model data

- Train the image classifier

- Classify the raster

- Create the initial analysis product

- Evaluate in 3D

- Challenge: Analyze image classification results

Supervised image classification workflow

Classifying a raster with the Image Classification Wizard

Lesson review

Answers to lesson 5 questions

6 Segmentation

Lesson introduction

What is segmentation?

Segmentation parameters

Segmentation parameter exploration

Exercise 6: Create a segmented raster

- Add the input raster

- Create initial segmentation

- Improve segmentation results

- Create the segmented raster

Lesson review

7 Training the classifier

Lesson introduction

Training sample considerations

Exercise 7A: Create training samples

- Add input data

- Evaluate the study area
- Configure the Training Samples Manager
- Collect training samples
- Save training samples

Types of image classification algorithms

Exercise 7B: Create a classified thematic raster

- Create a classifier definition
- Create a classified thematic raster
- Extract a target class
- Challenge: Calculate the percent per parcel

Lesson review

Answers to lesson 7 questions

8 Classification evaluation

Lesson introduction

Pixel Editor functionality

Compare Pixel Editor operations

Postprocessing classification results

Accuracy assessment workflow

Accuracy assessment statistics

Exercise 8: Create an accuracy assessment of classified results

- Evaluate input layers
- Reclassify pixels
- Add accuracy assessment points
- Complete the confusion matrix

Lesson review

Answers to lesson 8 questions

9 Image analysis with deep learning

Lesson introduction

What is deep learning?

Deep learning tasks for image analysis

Model Inferencing in ArcGIS Pro

The deep learning analysis workflow

Exercise 9A: Train a deep learning model using ArcGIS Pro

- Install the deep learning framework

- Create a map

- Prepare sample data

- Export training sample data

- Train a deep learning model

- Examine the model accuracy

Deep learning model metrics

Exercise 9B: Conduct deep learning analysis in ArcGIS Pro

- Download a deep learning model package

- Run a deep learning model

- Review the analysis results

- Postprocess the analysis results

Lesson review

Answers to lesson 9 questions

Appendices

Appendix A: Data license agreement

Appendix B: Answers to lesson review questions

Appendix C: Additional resources

Appendix D: Lesson stories