Instructor: Andy Mina
Grade Level and Subject: 12th Grade - Introduction to Computer Vision
Topic: Introduction to Convolutions
Lesson: 02_practice

NYS Computer Science and Digital Fluency Learning Standards	9-12.CT.2 - Collect and evaluate data from multiple sources for use in a computational artifact 9-12.CT.5 - Modify a function or procedure in a program to perform its computation in a different way over the same inputs, while preserving the result of the overall program.
Content Objective	Students will be able to: ● Perform 2D convolution with familiarity
Scaffolding Needed	Students should be able to: ● Perform 2D convolution at a base level ● Understand how the different types of border paddings influence the result of convolution
Key Vocabulary	**Zero padding:** missing values when convolving near the border are set to 0 **Circular padding**: missing values when convolving near the border are copied from the opposite end of the list **Replicate/duplicate padding:** missing values are duplicates of the nearest row/col **Symmetric padding:** missing values are filled as the reflection of the nearest rows/cols
Assessments	Roll for Confidence (Formative) Students will be asked to “roll for confidence” and respond by showing the instructor a number from 1 to 5 on one of their hands. Their confidence is representative of how comfortable they feel in continuing to explore and compare other sorting algorithms on their own. Scores represent the following: 1. **Not confident.** Needs a re-explanation or summary of the lesson with emphasis on key points. 2. **Pretty shaky.** Needs a brief recap and some teacher-guided practice to solidify concepts and understanding. 3. **Okay.** Needs some peer-guided practice and some more time to let things sink in. Ideal rating after

	the lesson. 4. **Pretty confident.** Needs some peer-guided practice for more challenging algorithms, but is self-sufficient for what's covered in class. Ideal rating before a unit test. 5. **Extremely confident.** Needs little to no guidance and can tackle problems of exceptional difficulty with relative ease. Indicative of an under-challenged student. These checks shouldn't take any longer than one minute.
Materials	02_slides, 02_homework

Lesson Component	**Description or Execution of Lesson Component (w/ scripting when appropriate)**
Essential Question	How do we perform 2D convolution?
Do Now	**S1, 5m** Prompt students to ask their partner any questions they might have about the past two lessons or convolutions. If neither student has questions, they should search the internet for convolutions and see if they can teach each other something new. Once students have had ~2m to ask and answer, ask the class if there are any unanswered questions and answer them.
Presentation of Content	**S2-3, 2m** Review the lesson's agenda and convolution border solutions. Stop for questions if there are any. **S4-7, 4m** Review the 2D convolution process with students as a class. Note to students again that the input array is red and the kernel is blue so the overlap will be purple. If there are students who are confident in walking the class through the process, have them lead, but reinforce every step.

	S8-12, 2m Go through the convolution process here a little bit quicker. These slides are more so to show the repetitive nature and clockwork of convolution. Once you get the process down, it becomes a lot easier to convolve since the same process is applied everywhere. **S13-14, 2m** Point out to students that even if it looked like the result was going to be 128 everywhere, we should still calculate. It's extremely easy to fall into false patterns when convolving. Stop for questions and roll for confidence. **S15-16, 5m** Students should work on this problem in pairs. Note that we can parallelize convolution. Since the result of one pixel does not influence the next, each person in the pair can start at different places and meet in the middle. **S17-19, 8m** Assign students to work on this problem solo. Feel free to refer to earlier slides for the process. Roll for confidence
Homework	02_homework, one convolution problem