

Matrices, Images, and Movies

An image as a matrix

- ▶ Represent an image by a **matrix**
- ▶ Each pixel has a corresponding entry in the matrix - the RGB value (color) or the gray scale (black-white)



$$\begin{bmatrix} 156 & 159 & 158 & 155 & 158 & \dots \\ 160 & 154 & 157 & 158 & 157 & \dots \\ 156 & 159 & 158 & 155 & 158 & \dots \\ 160 & 154 & 157 & 158 & 157 & \dots \\ 156 & 153 & 155 & 159 & 159 & \dots \\ \vdots & \vdots & \vdots & \vdots & \vdots & \dots \end{bmatrix}$$

How Harry Potter becomes invisible*



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*Thanks to Tim Chartier, Davidson College

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- ▶ Read the two images as matrices
P: Harry in Hogwarts, *H*: Hogwarts

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P: Harry in Hogwarts, *H*: Hogwarts
- ▶ Progressively calculate a new matrix *N*:

$$N = (1 - \alpha)P + \alpha H; \quad 0 \leq \alpha \leq 1$$

Display each matrix *N* as an image, in succession

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- ▶ At $\alpha = 0$ Harry is there; at $\alpha = 1$ Harry is invisible