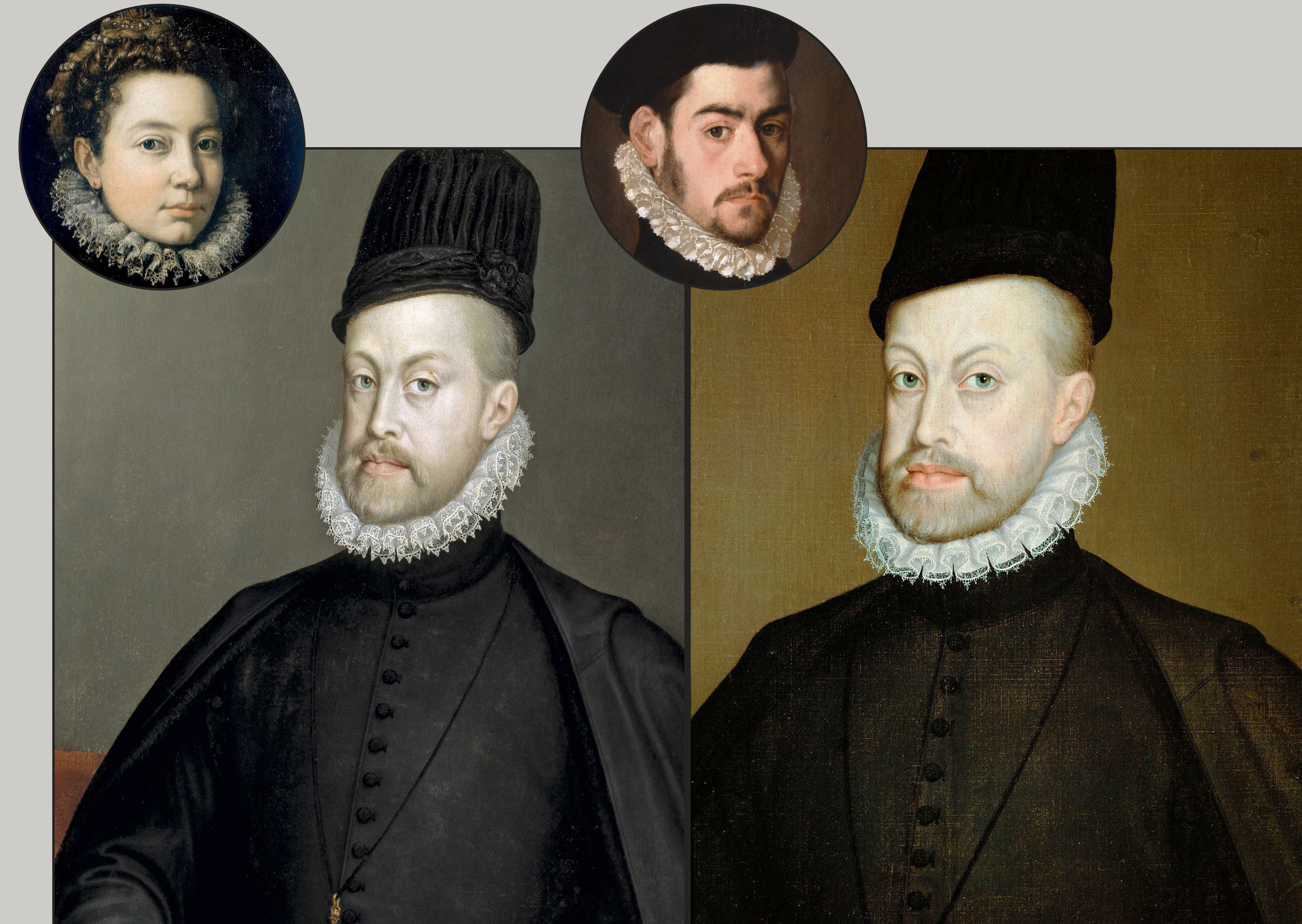# Interconnected Identities: Neural networks, Renaissance portraits, and the possibilities of artistic collaboration

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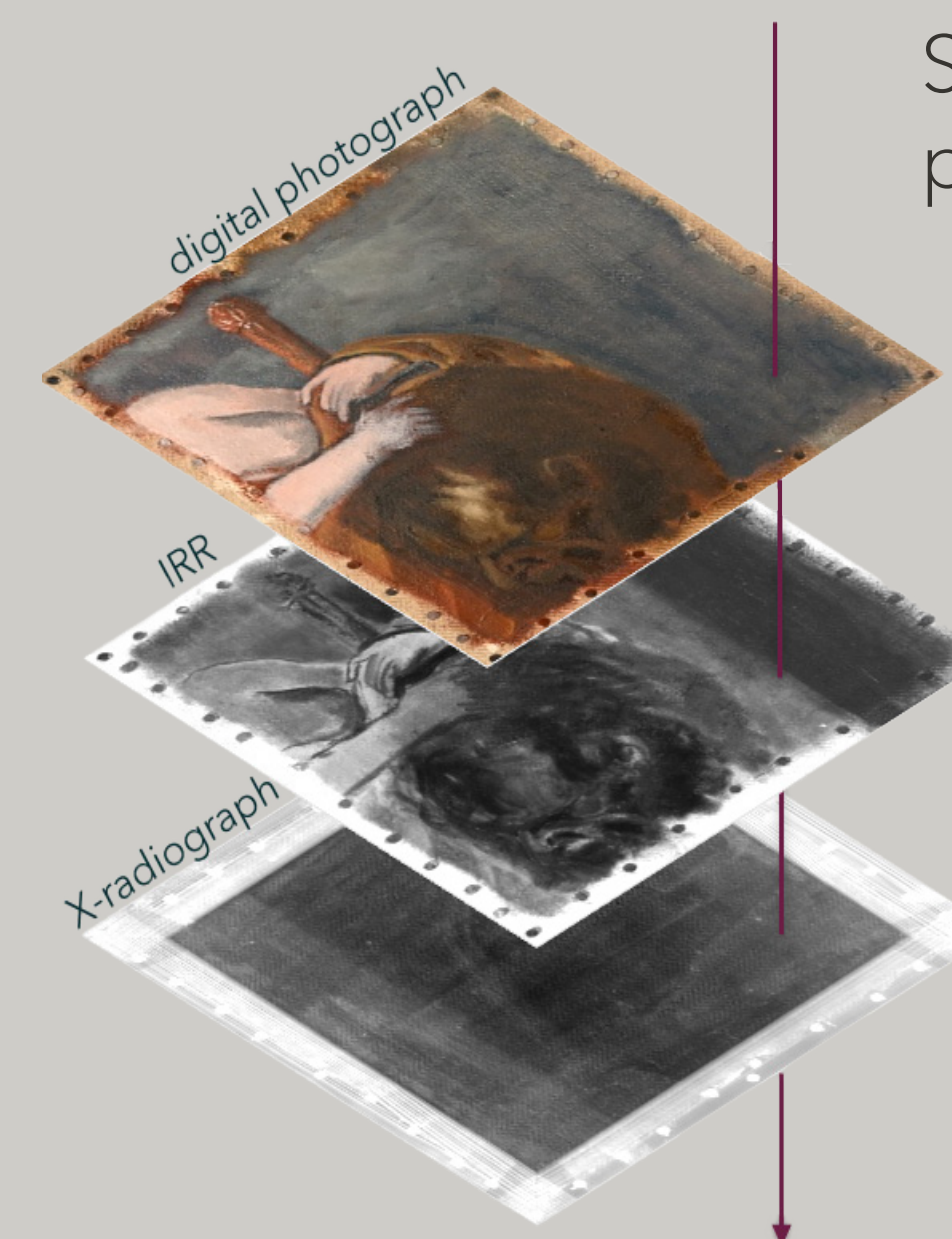## Same Artists, Same Workshop, Same Materials

Between 1560 and 1572, Philip II of Spain brought together skilled portraitists from diverse regions of Europe, facilitating the creation of a collection of portraits painted in a unified and potentially highly collaborative Habsburg style. Due to this stylistic unity, the significant contributions of individual artists have historically been challenging to determine by visual analysis alone. Within this context, is it possible to identify the contributions of two notable portraitists of the Spanish court: Alonso Sánchez Cuello and Sofonisba Anguissola?
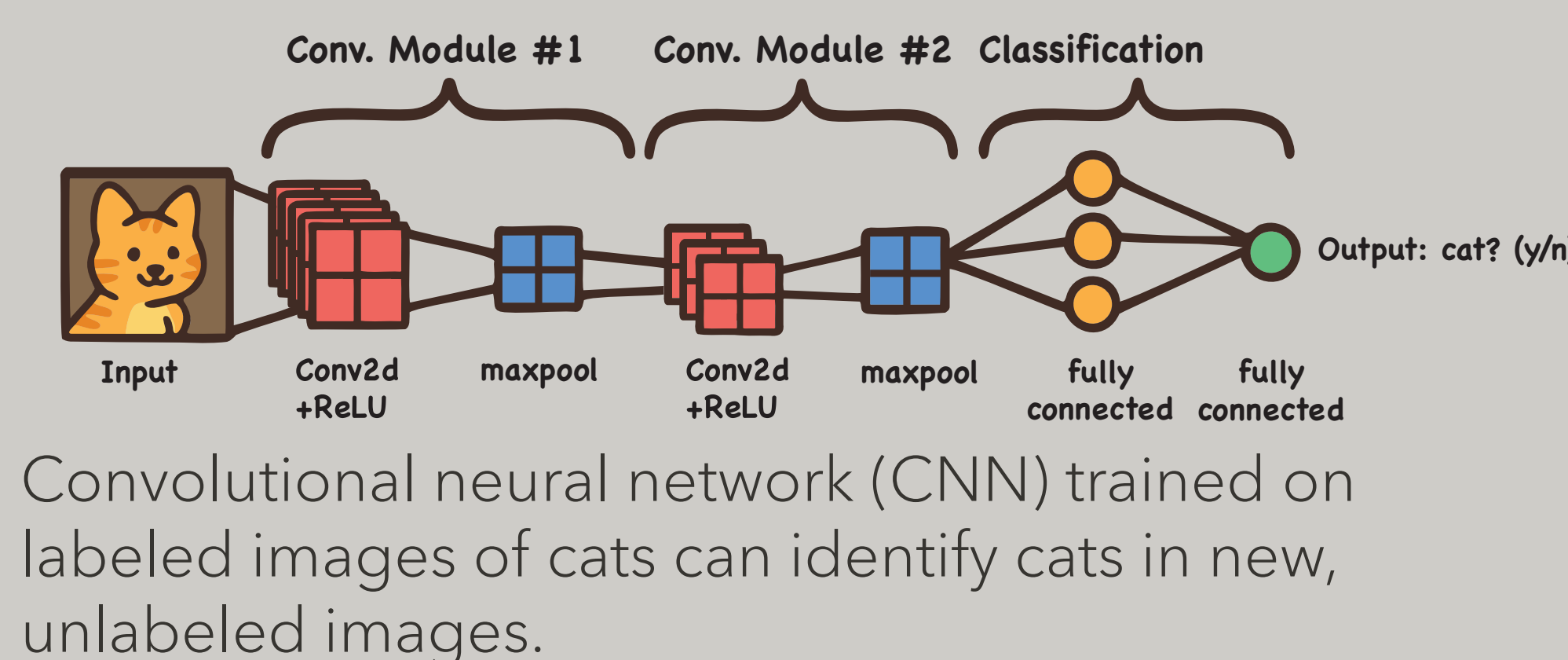
Finding Multiple Artists in One Canvas?

- When multiple artists work in the same location using the same materials to paint the same sitters, are they likely to collaborate in this setting? What techniques might facilitate the identification of individual hands within a single or small number of works?

- Can machine learning seek across multiple works for evidence of collaboration in Renaissance/Baroque paintings featuring a high degree of similarity and fine-grained detail?

- What combination of imaging modalities and machine learning parameters most successfully overcomes the systematic biases characteristic of computer vision?

Multi-modal Imaging & Neural Networks

- Simple model system with controlled parameters—6 replica paintings by students: 5 by individual artists, 1 collaborative

- Multi-modal images of each painting combined into data stack, amplifying features and minimizing hardware-based bias

- Convolutional neural network (CNN) applied to image stacks to classify features within collaborative painting

Sofonisba Anguissola (upper left) and Alonso Sánchez Coello (upper center). Portraits of Philip II of Spain. Prado (left), Kunsthistocrishes Museum (right).

Single painting data stack of visual digital photograph, infrared, and x-ray image.

Convolutional neural network (CNN) trained on labeled images of cats can identify cats in new, unlabeled images.

Probability Maps from Paint

- Following training, CNN produces a probability "heat" map of the collaborative painting

- Regions classified by probability of correlating to an artist represented in the training set

- Probability map compared to qualitative knowledge of regions painted by individual artists, evaluating the CNN accuracy of correctly identifying known regions of collaboration

Judith with the Head of Holofernes, Studio of Padovanino, c. 1635. The Courtauld; Six student replicas, 2024.

Untangling the Interconnected Identities

If this method of neural network computational analysis yields promising results, we hope to apply it in further research to extant portraits of the 16th c. Spanish court, again seeking regions of collaborative contributions by different artists (where there is minimal information of artistic interaction within the written record). Ideally, this would allow us to "untangle" the interconnected identities of the disparate artists who worked in close contact to create the unified and detailed visual record of the royal family they served.

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