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Sandia National Laboratories

OPTIMIZING A COMPRESSIVE IMAGER FOR MACHINE LEARNING TASKS

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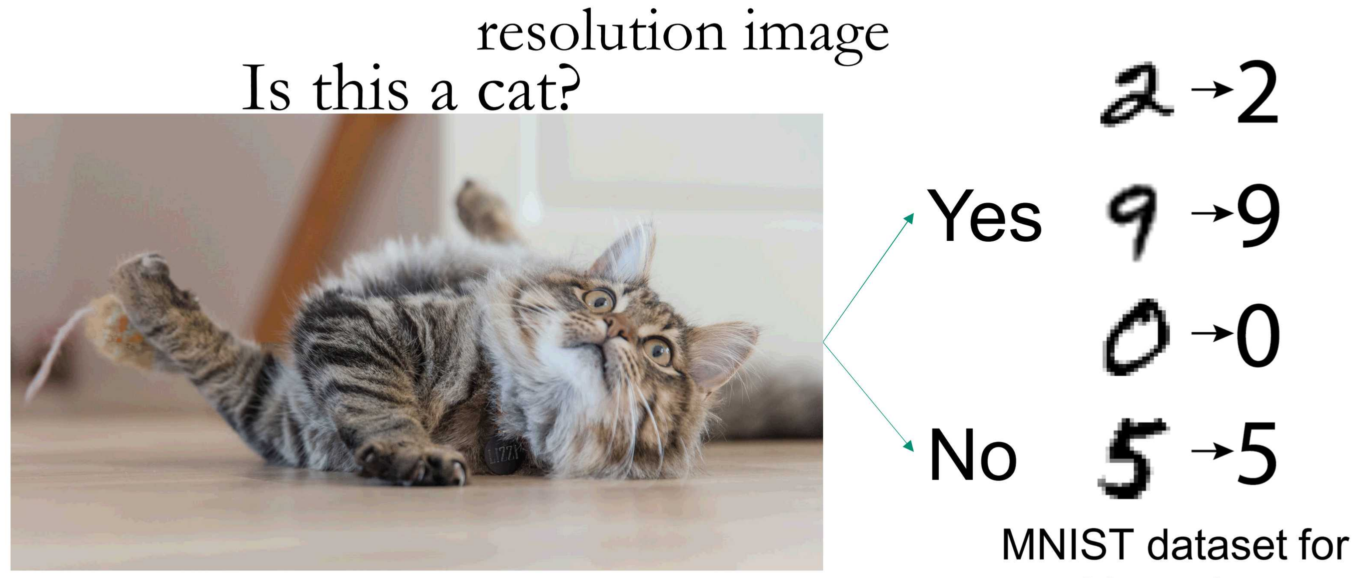
Task-specific optical systems

The final data product is a decision not a high resolution image

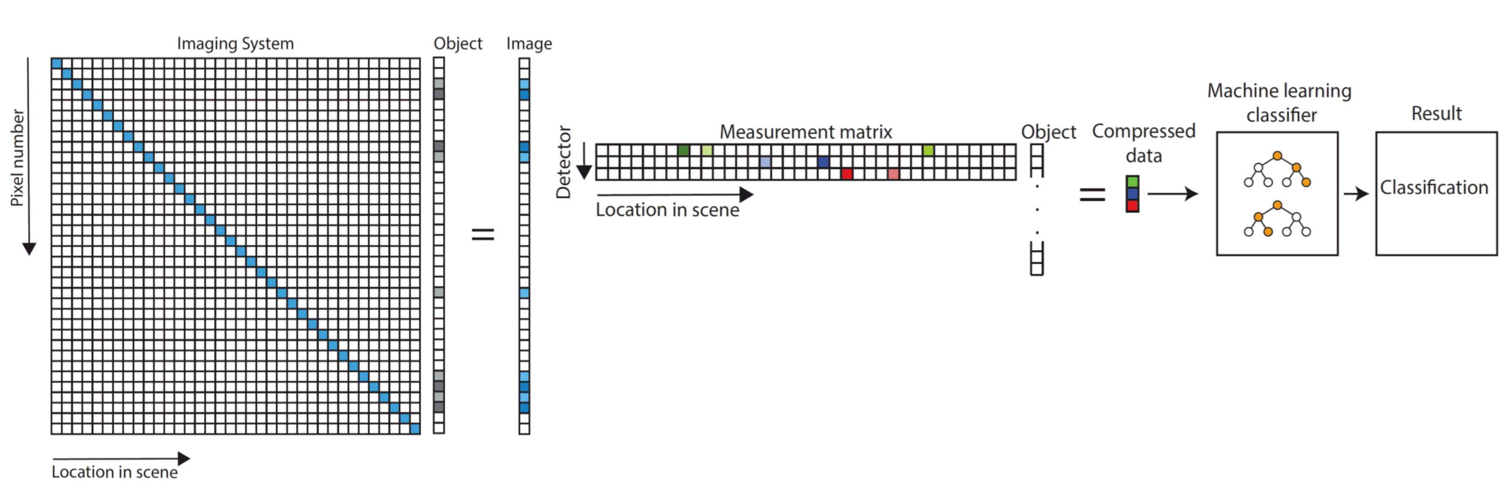
Is this a cat?



MNIST dataset for this project

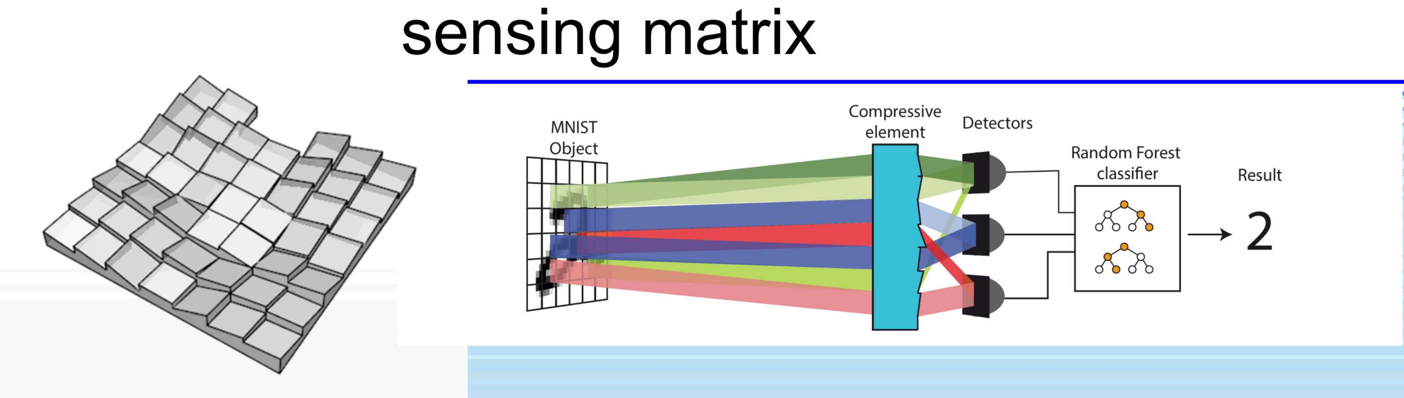
Compressive Classification

Unconstrained by imaging



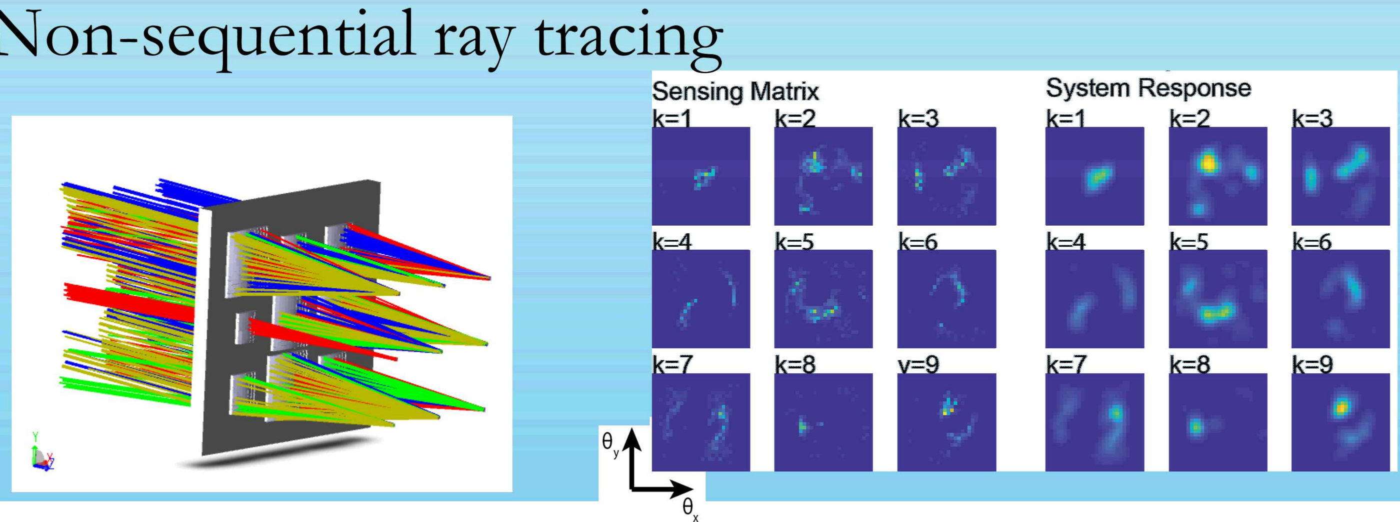
Prism arrays

Monolithic hardware to realize compressive sensing matrix



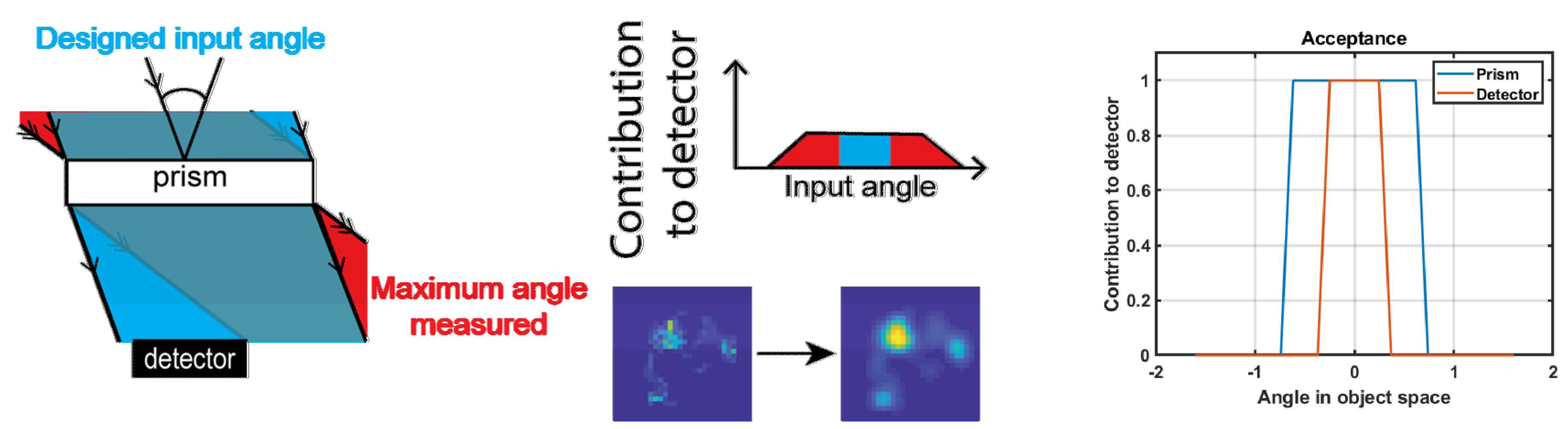
Simulations of hardware

Non-sequential ray tracing



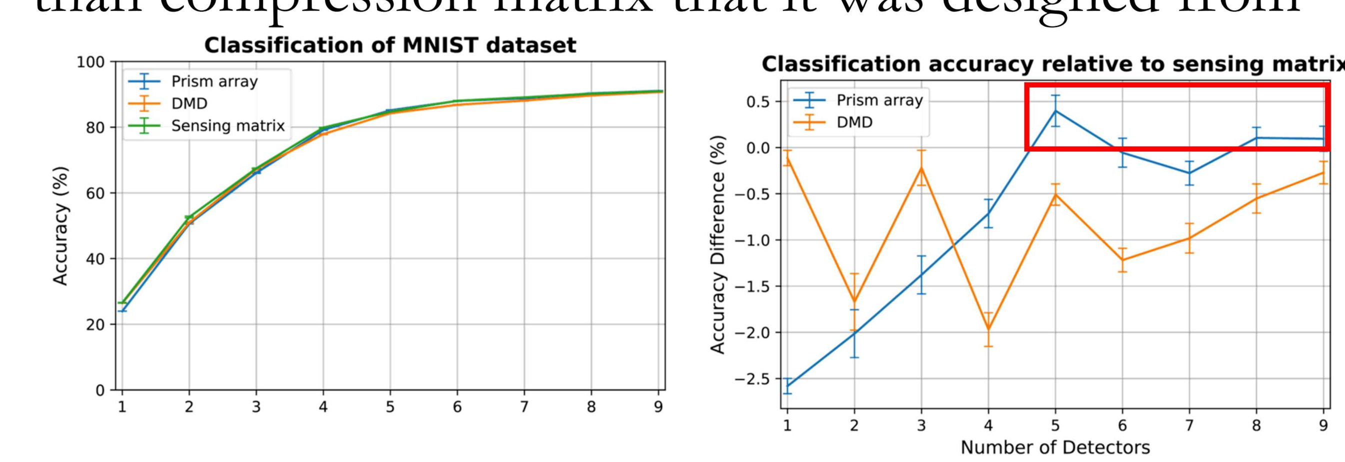
Blurring

Width of prism sets cone of light accepted



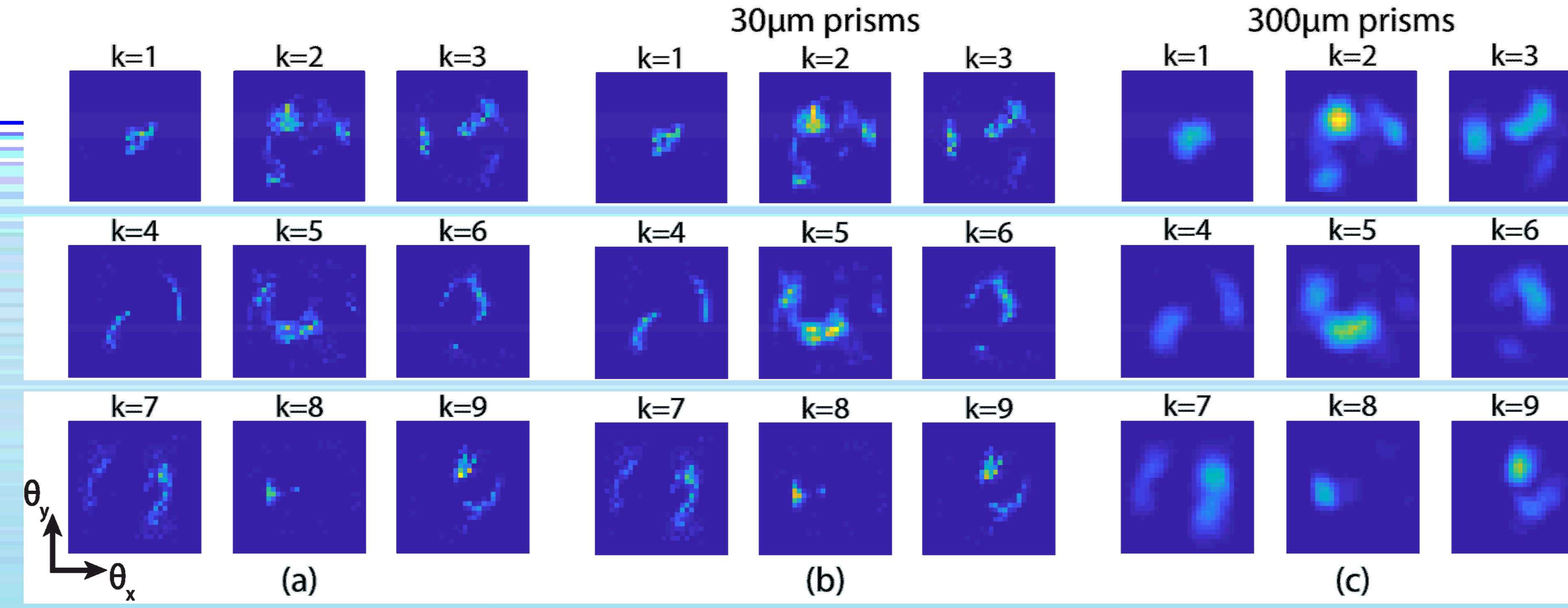
Classification Accuracy

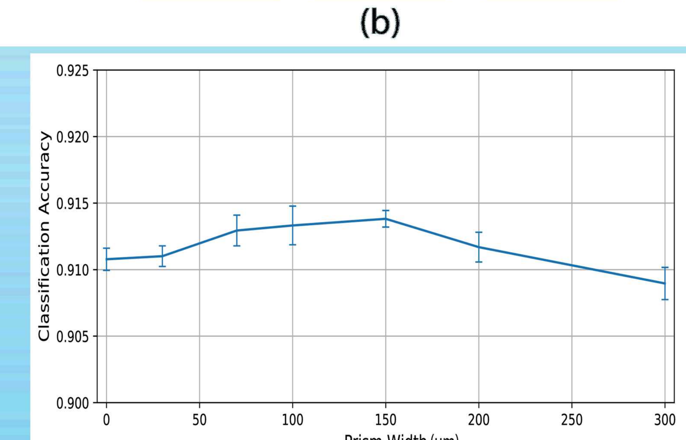
Blurred system response matrix had higher accuracy than compression matrix that it was designed from



Changing Prism size

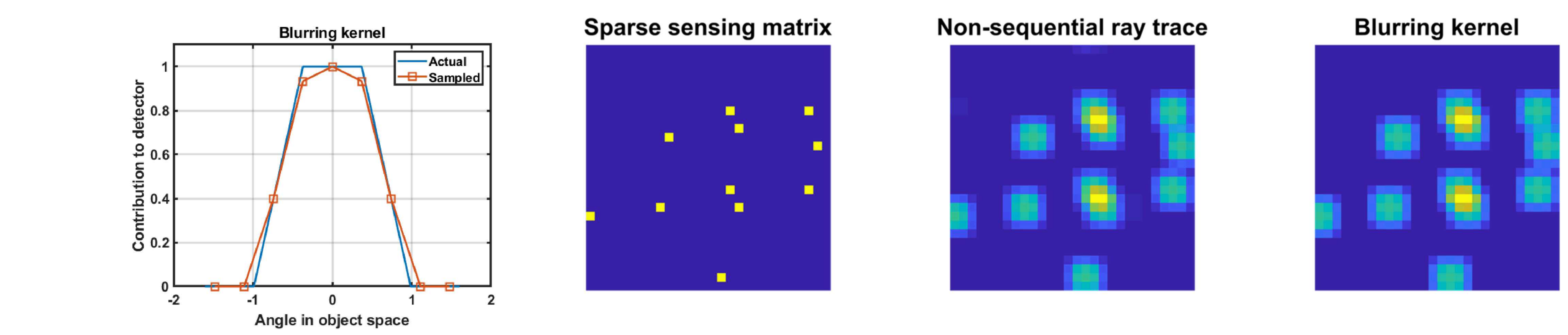
Simulations changing size of prism without re-optimizing





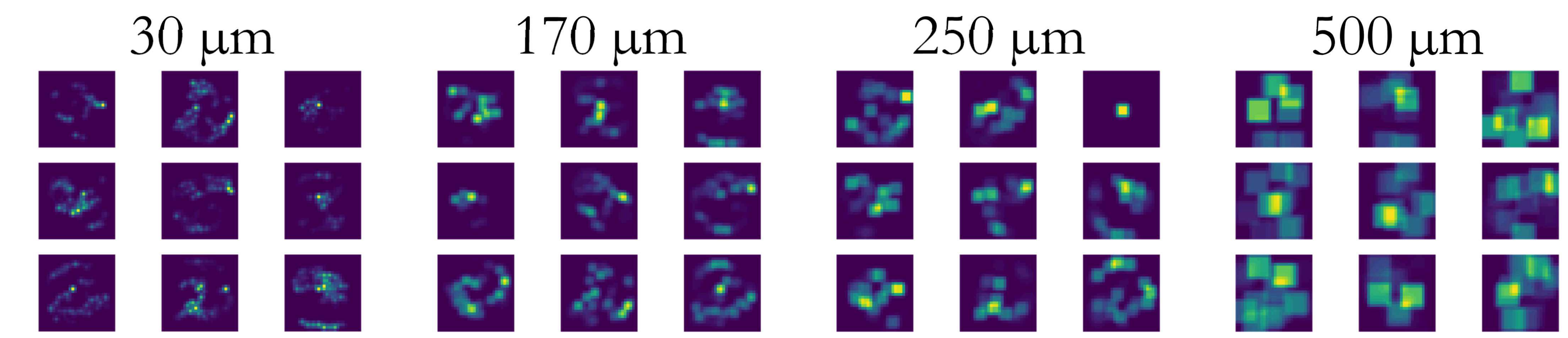
Simulating blurring

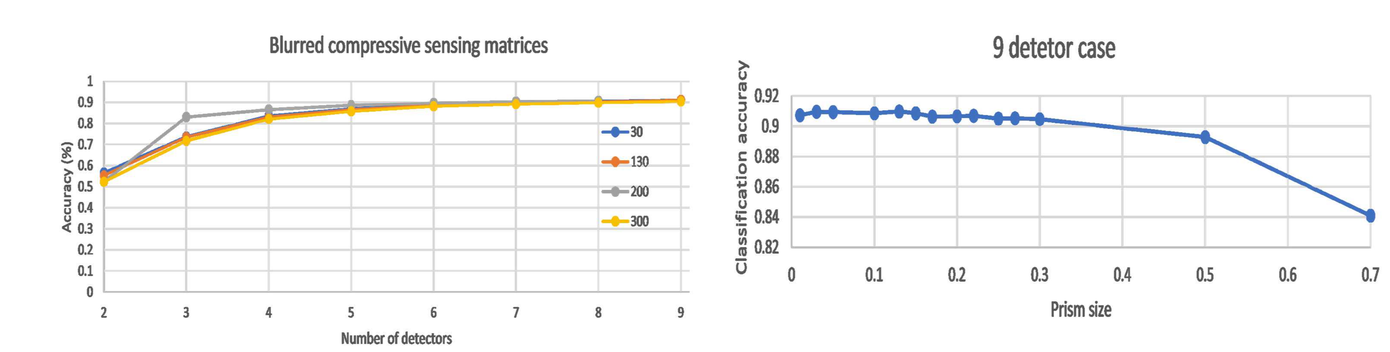
Blurring kernel faster than non-sequential ray trace



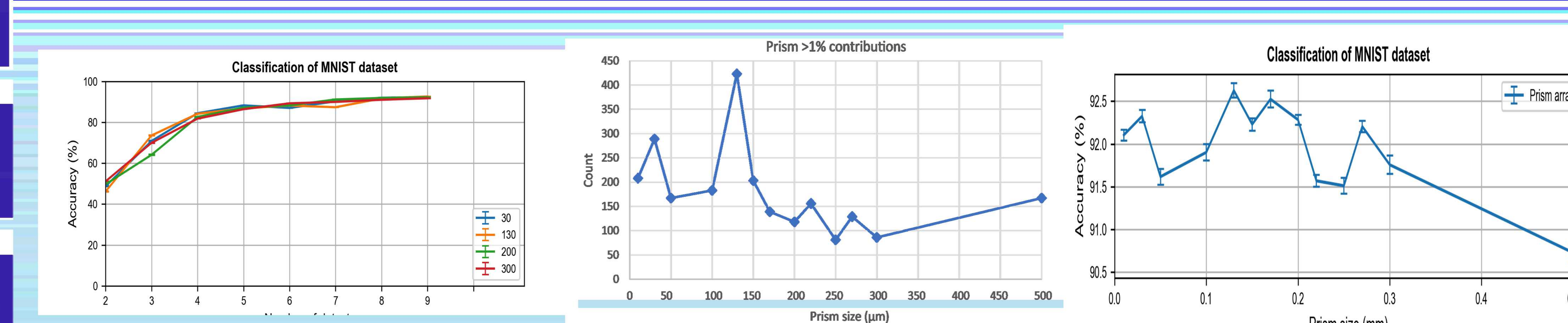
Optimizing prism size

Neural network optimizes compressive sensing matrix based on the prism width





Removed prism <1% contribution



Conclusion

Concurrently optimizing the sensing matrix and the hardware design has the potential to both improve performance and increase sparsity.

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