UNIVERSITAT POLITÈCNICA DE VALÈNCIA

COTG-135. Grupo de Redes de Computadores (GRC).

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On the Applicability of the Hadamard as an Input Modulator for Problems of Classification.

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Accepted under the REPRODUCIBILITY Badge Initiative by Code Ocean.

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C++ library that includes a complete learning framework.

https://doi.org/10.24433/CO.3851581.v1

https://github.com/curto2/mckernel

CODE OCEAN

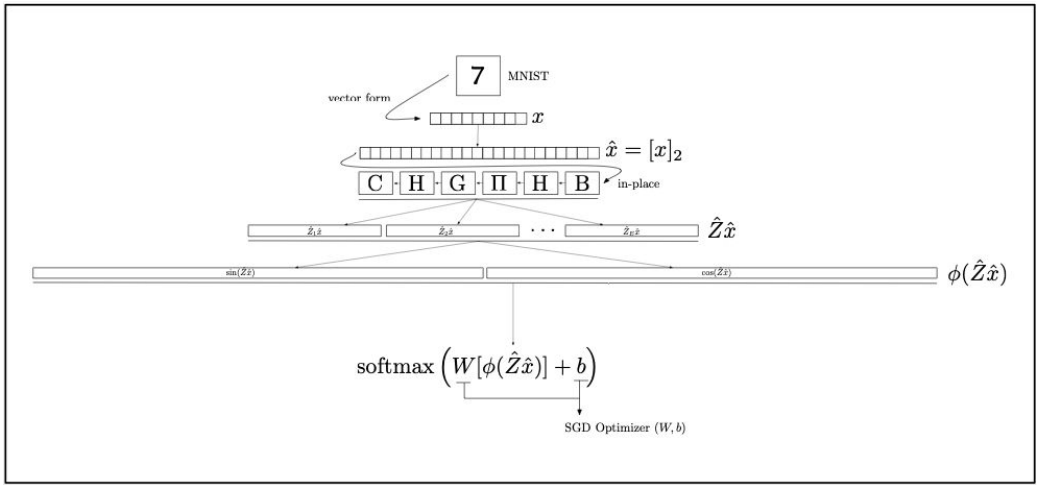

Figure 1: **Diagram of McKernel**. We visually describe softmax$(W\tilde{x}+b)$ where $\tilde{x} = \text{mckernel}(x)$. The original image is padded in form of long vector to the nearest power of 2, mapping $\hat{Z}$ is applied in-place. Calibration C defines the choice of Kernel. The tensor is expanded by the number of Kernel Expansions E building a network with high compositionality. Finally, use real feature map ϕ, Equation 2. SGD Optimizer finds appropriate weights W and bias b. Compute $\hat{Z}$ on-the-fly keeping same seed both for training and testing.

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Highlights

● C++ fast open-source Hadamard that works for any input size. Widely deployed in Signal Processing, Communications and Compressed Sensing.

● Approximate kernel expansions in log-linear time.

● Useful to foster new DL architectures with better human-induced/mathematical priors.

● DL research framework. Domains that could be further explored are: end-to-end training, self-supervised learning, meta-learning, integration with evolution strategies, NAS reducing substantially the search space and many others.

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Impact overview

- Useful in large-scale setting to turn any linear classifier into non-linear, wherever SVM is still useful over DL methods. For instance, in robotics, unmanned aerial vehicles and ML for healthcare when the number of samples to train on is relatively bounded.

- It offers multiple open questions: learning C and G adapts the type of kernel. Learning B acts as a mechanism of attention.

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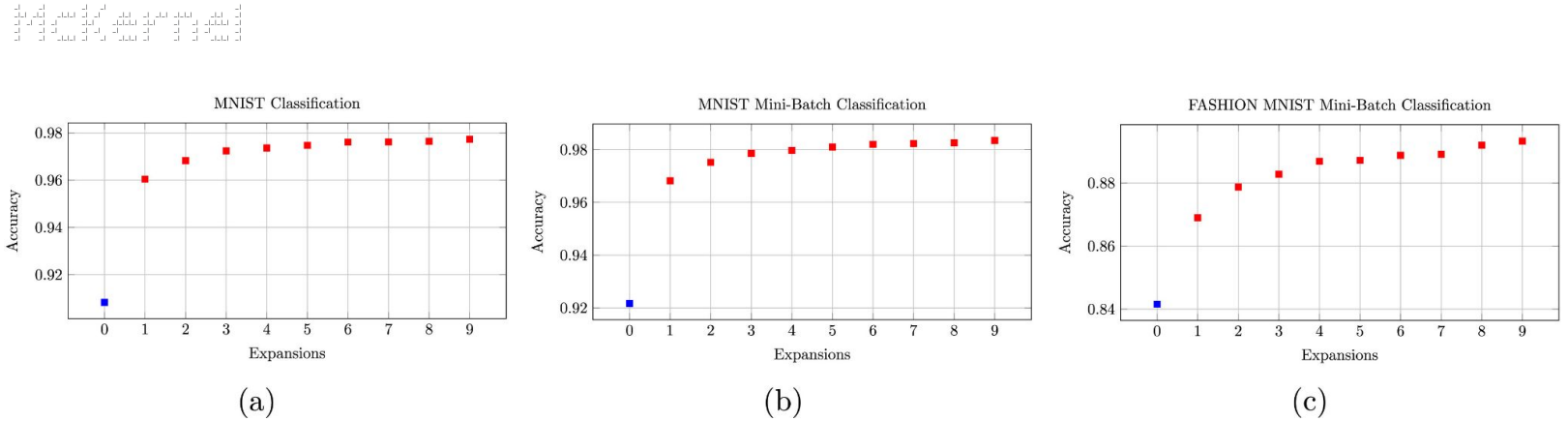

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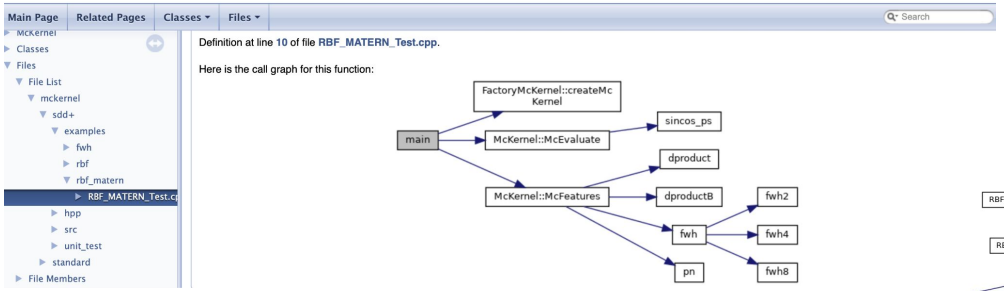
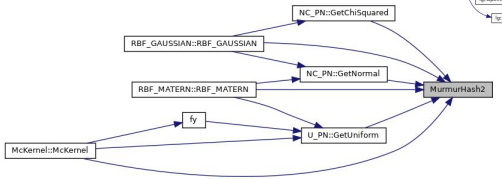
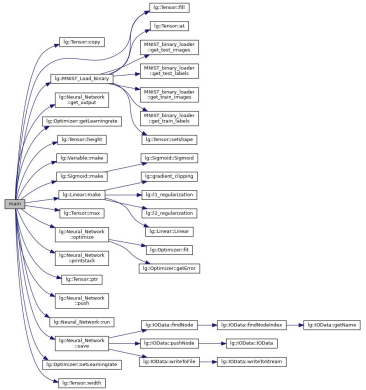
Documentation for McKernel.







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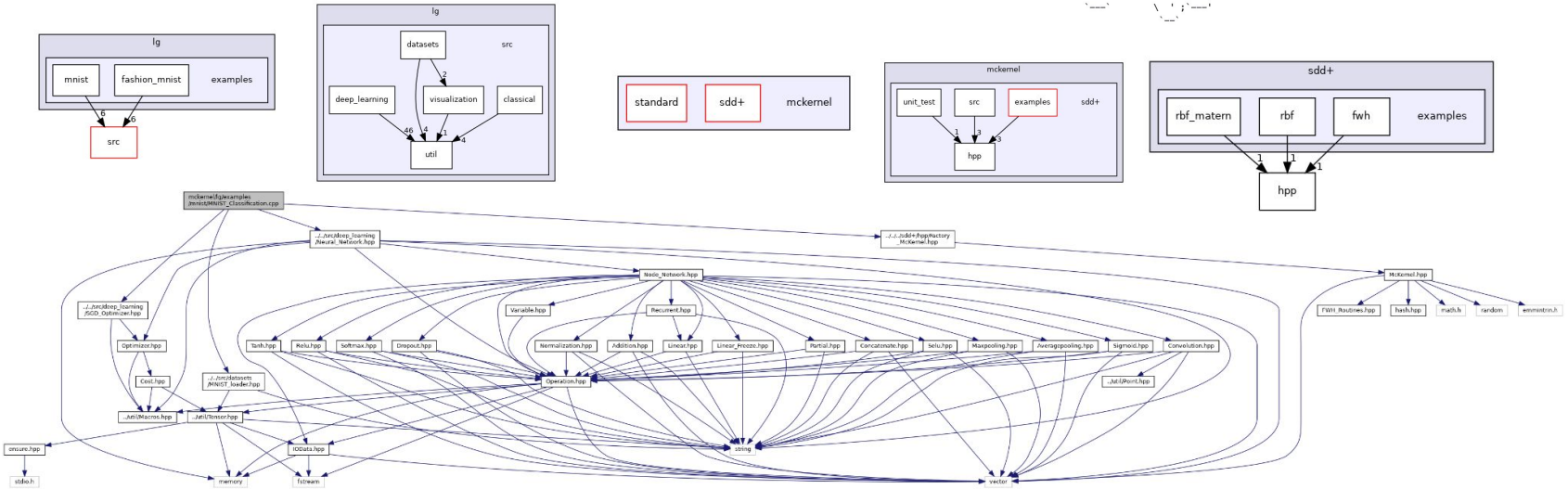

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