

MPI Communicators

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Introduction

The purpose of this exercise is to investigate the MPI communicators. You will start with a working MPI parallelised image processing code.

Advanced use of collectives

Imagine you want to sum the pixel values for each row and column in an image, i.e. in pseudocode:

- loop over $i = 1, M; j = 1, N$
 - $verticalsum_i = verticalsum_i + image_{i,j}$
 - $horizontalsum_j = horizontalsum_j + image_{i,j}$
- end loop

How would you parallelise this calculation so that rank 0 knows the vertical and horizontal sums for the complete image in the following cases:

- the image is decomposed across processors over one of its dimensions;
- the image is decomposed across processors over both of its dimensions.

Try to do this using collective operations rather than point-to-point communications. For the second case you should use create new communicators, e.g. look at the routine `MPI_Cart_sub`.