Teaching distributed computing using Raspberry Pi clusters at a distance

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1. Module Context

TM129 *Technologies in Practice* is a compulsory Level 1 BSc (Honours) Computing & IT module. It hosts around 1,800 students annually and is based on three topics – Robotics, Networking and Operating Systems.

We want to provide greater exposure to novel computing concepts, specifically computer clusters which provide large amounts of processing power to solve a range of everyday problems including decrypting data and image processing. One relatively-low cost approach to clusters is using everyday hardware such as the inexpensive Raspberry Pi computer. Our eSTEeM project focuses on exploring the benefits and challenges of teaching about computer clusters at a distance using low-cost Raspberry Pi clusters.

2. Device Construction

Six custom-made Raspberry Pi clusters have been constructed by the module team. These will be hosted in the OpenSTEM Labs and can be accessed by students over the Internet to perform a range of activities. Students will complete the activities and compare the performance of the clusters to a conventional single processor computer.
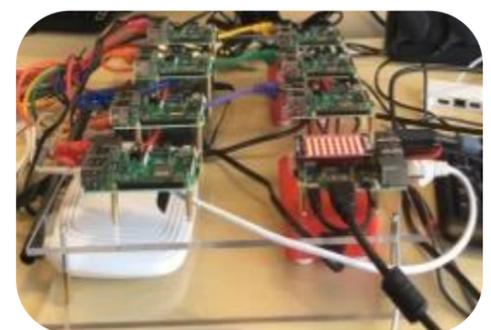
3. Learning Activities

Three processor-intensive programs have been developed for the cluster. The *'Image Combiner'* (*below*) is a graphical problem: how to create a single 'clean' image (the Christmas ducks) by removing obstructions that appear in several original images (the Christmas ducks with various visiting ducks). The maths is simple – each pixel in the final image comes from taking the median (ie the most common value) of the corresponding pixels in all images, effectively ignoring any obstructions. However, there are millions of pixels in each image…
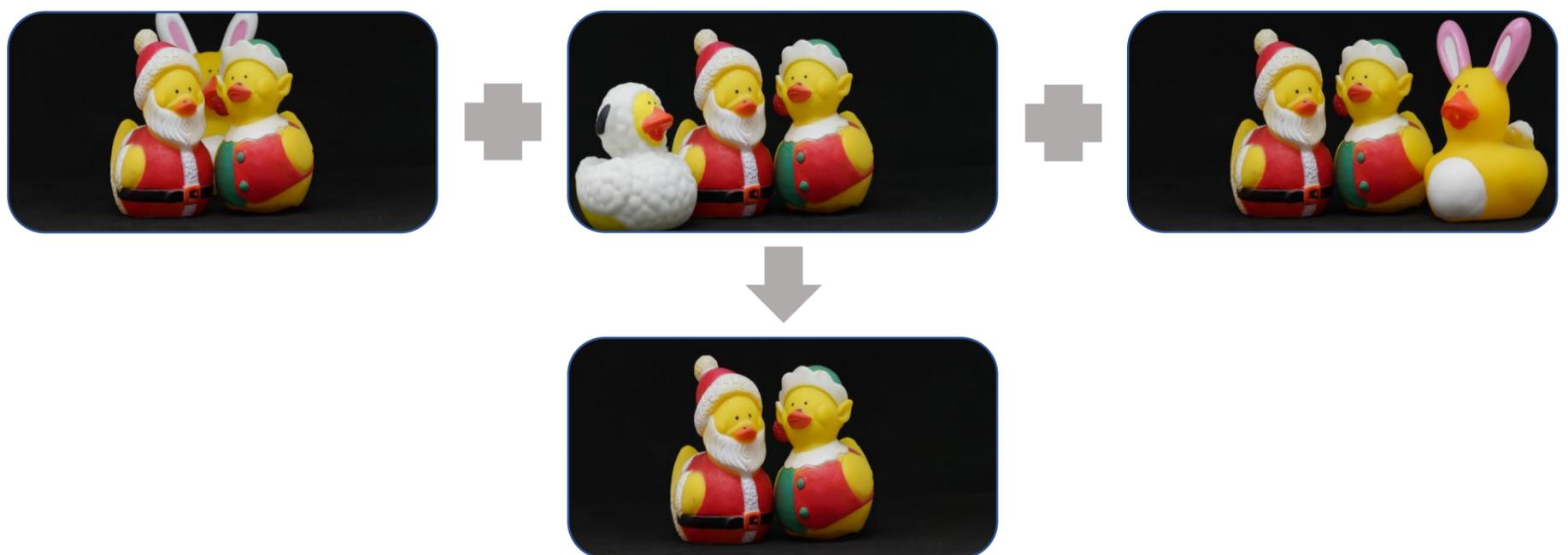
4. Student Evaluation

Our eSTEeM project is based around running questionnaires alongside the Raspberry Pi cluster activities for the 19J and 20B presentations of TM129. The questionnaire will examine 1) increased engagement and interest of the students due to the novelty of the technology; 2) that the activities will increase students' knowledge of cluster computing; and 3) that the increased engagement and interest will improve retention.

The survey will be supplemented by examining SEaM data and a small number of structured interviews.

eSTEeM
The OU centre for STEM pedagogy