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## **Compute-and-Forward in Cell-Free Massive MIMO: Great Performance with Low Backhaul Load**

Qinhui Huang and Alister Burr

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Abstract—In this paper, we consider the uplink of cell-free massive MIMO systems, where a large number of distributed single antenna access points (APs) serve a much smaller number of users simultaneously via limited backhaul. For the first time, we investigate the performance of compute-and-forward (C&F) in such an ultra dense network with a realistic channel model (including fading, pathloss and shadowing). By utilising the characteristic of pathloss, a low complexity coefficient selection algorithm for C&F is proposed. We also give a greedy AP selection method for message recovery. Additionally, we compare the performance of C&F to some other promising linear strategies for distributed massive MIMO, such as small cells (SC) and maximum ratio combining (MRC). Numerical results reveal that C&F not only reduces the backhaul load, but also significantly increases the system throughput for the symmetric scenario.

Alister Burr  
Dept of Electronics,  
University of York  
York YO10 5DD,  
UK  
Phone: + 44 1904 322352  
Email: alister.burr@york.ac.uk