The study of ants interacting and organizing themselves is applicable to many different fields. A step by step process based on ant colonies is presented for image coding and compression. The authors stated that they have read the research already done on ant colonies including traveling salesman problem and using a similar algorithm for fractal image compression. Yet ant colony logic had yet to be applied to lossless image compression for binary images. The algorithm that this paper proposes is “derived from the behavior of real ants; to design any movement rules which are fed into the algorithm; to utilize the power of arithmetic encoding algorithm in ant movement to provide a higher compression ratio; and to apply it to images simulated as virtual environments which contain ants, food, and routes for ants to move and search for food.” Binary image coding and compression are the applications of any colonies in this paper.

The authors propose representing a binary image as a virtual world which contains ants, food, and routes where ants can walk and collect food. First the binary image is converted to a food route image by replacing the “1”s with food and pixels with “0”s are assigned to be routes. Set the boundaries of the image and start recording the ant’s movement. Next ants are randomly dropped within the boundaries so that no two ants are place on the same pixel at the same time. Step four in the algorithm says for the ants to record if they are on a food cell or not. If not dropped on top of a food pixel to begin, the ant will start searching for food by going in one of the following directions: up, down, left, right. The ant records the location of the food cell and looks at neighbors. The next step involves ants releasing pheromones to the eight cells surrounding it when it records a food pixel. Other ants in the virtual world are attracted to the pheromone and will make other ants more likely to visit the route that has produced food. The density of pheromone in each cell in the virtual world varies and dissipates after the second movement of an ant. After normal movement, the ant makes a decision to move to a neighboring cell based on if neighbor has food, pheromone in neighbor, explored cell, less ant density, or an advance direction. If 10 advance movements are recorded it is recorded as ‘Huge Advance’, between 4 and 10 movements is recorded as ‘Intermediate Advance’ to obtain a higher compression ratio. Finally, arithmetic coding was used to compress higher frequency variables to save space.

The approach was more effective than non-encoding, G3, G4, JBIG1, and JBIG2. The evaluation was done by comparing the number of bits needed to represent the chain of movements after arithmetic encoding and compared with the number of bits produced by the other algorithms mentioned. One limitation so far of this algorithm is that is only applied to binary level images. Future applications of this algorithm include applying it to minimizing lateness of multimedia data object requests for internet applications. the problem is modelled as a two machine flowshop problem of minimizing maximum lateness with separate setup times. Using ACO in web mining so that the ants find similar web sessions of people using the net to help with customer identification.