Two devices using image-based methods to determine particle size distribution of soil are developed. Sedimaging, a device that determine particle size distribution of soil between 0.075 mm and 2 mm, utilizes a statistical method called wavelet transformation. Translucent Segregation Table or TST, a device that determine particle size distribution of soil between 2 mm and 25 mm, utilizes a deterministic method called watershed segmentation. Both devices generate particle size distributions of soil that match well with sieving results.

For the Sedimaging test, internal particle textures may be interpreted as smaller particles thereby underestimating the actual particle sizes. Thus, development of a soil-specific calibration curves is recommended to analyze soil particles with erratic internal textures. A statistical approach to characterize particle orientation or fabric and particle shape is proposed. An energy ratio (F) is defined, and the mean and absolute value of F are used as an indicator of particle orientation and particle shape, respectively. A deterministic approach utilizing mean-shift clustering is proposed to determine aspect ratios of individual particles. The method requires a first estimate of window radius (R) that can be obtained by wavelet transformation and well-segmented particles are selected manually for computation of the aspect ratios.

For the TST test, bridges are used to prevent small particles from hiding beneath large particles and to estimate the smallest particle dimension (d3) from the average of two bounding bridge heights between which each particle comes to rest on the TST. d3 is used to determine the volume-based particle size distribution of a soil. To correct minor axis dimension (d2) to sieve size (d), a d2 correction factor is derived based on the ratio between d2 and d3. A method that handles over-segmentation associated with elongated particles from watershed segmentation results is proposed. From the results of watershed segmentation pairs of over-segmented particles are selected manually, and each pair of selected objects is combined to become one particle.

For future directions, implementing a higher magnification camera, developing a linear calibration using a single empirical parameter (T), and utilizing morphological opening for particle size distribution determination are discussed.