Fuel burn reduction in commercial aviation using Mathematical Morphology

Dumitru Abrudan, Ana-Maria Drăgulinescu, Radu-Ovidiu Preda, Nicolae Vizireanu
Telecommunications Department, University Politehnica of Bucharest, Bucharest, Romania

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Motivation

Transportation of people or merchandise all over the world is a developing activity year by year. With this activity, one

of the natural resources, respectively the oil, is extracted and refined to be used for thermal engines. The oil is not

unlimited and the consumption of each liter of oil impacts the climate. Therefore, it is necessary to take measures to

mitigate these issues. Factors as demand and instability (as currently the war in Ukraine) affect the fuel price. Each

person must be responsible for environment protection and for the natural resource's preservation.

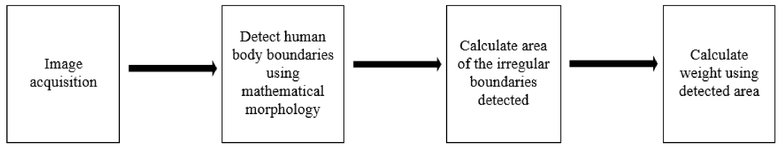

Figure 1. Flowchart of the proposed algorithm

Main issue of current solutions

In the processed images were identified issues that affect the proper weight detection caused by people with long hair, loose clothes and tall shoes.

RQ: Does this proposed algorithm estimate the proper weight ?

Applying the method proposed, the relative errors of the weight estimated with respect to real weight ranged between 90.20% to 94.10% for men and 90.10% to 93.10% for women.

Experiment and results

The processed image was converted into a binary image to remove the noise that could affect the weight determination (Figure 1).

Figure 1. Original image and segmented image

The mathematical morphology operator used in the proposed algorithm is erosion. This will ensure that the irregular boundaries of the human body detected are as thin as possible. A thin layer of pixels will ensure the errors decrease when computing the area (Figure 2).

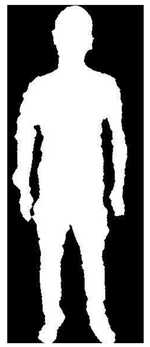

Figure 2. Processed image with erosion mathematical morphology

Using the elliptical tube volume formula in Figure 3 is presented the accuracy of weight detection for women.

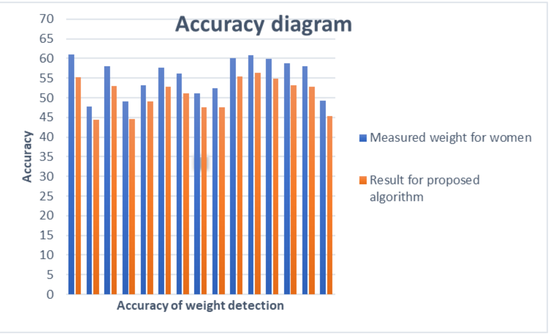

Figure 3. Accuracy of weight detection for women

Using the same formula in Figure 4 is presented the accuracy of weight detection for men.

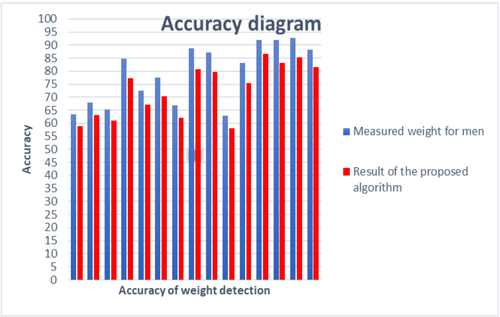

Figure 4. Accuracy of weight detection for men

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Conclusions

Using the proposed algorithm for passenger weight determination it was observed that extra fuel consumed by the airplanes can be reduced thus resulting in reduction of CO_2 emissions.