

**Title** Development of a machine for the automatic sorting of pomegranate (*Punica granatum*) arils based on computer vision

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### **Abstract**

The pomegranate is a fruit with excellent organoleptic and nutritional properties, but the fact that it is difficult to peel affects its commercialisation and decreases its potential consumption. One solution is to market the arils of pomegranate in a ready-to-eat form. However, after the peeling process, unwanted material, such as internal membranes and defective arils, is extracted together with good arils and must be removed on the packing line because the presence of such material shortens the shelf life of the product or deteriorates its appearance. For different reasons, the commercial sorting machines that are currently available for similar commodities (cherries, nuts, rice, etc.) are not capable of handling and sorting pomegranate arils, thus making it necessary to build specific equipment. This work describes the development of a computer vision-based machine to inspect the raw material coming from the extraction process and classify it in four categories. The machine is capable of detecting and removing unwanted material and sorting the arils by colour. The prototype is composed of three units, which are designed to singulate the objects to allow them be inspected individually and sorted. The inspection unit relies on a computer vision system. Two image segmentation methods were tested: one uses a threshold on the R/G ratio and the other is a more complex approach based on Bayesian Linear Discriminant Analysis (LDA) in the RGB space. Both methods offered an average success rate of 90% on a validation set, the former being more intuitive for the operators, as well as faster and easier to implement, and for these reasons it was included in the prototype. Subsequently, the complete machine was tested in industry by working in real conditions throughout a whole pomegranate season, in which it automatically sorted more than nine tons of arils.