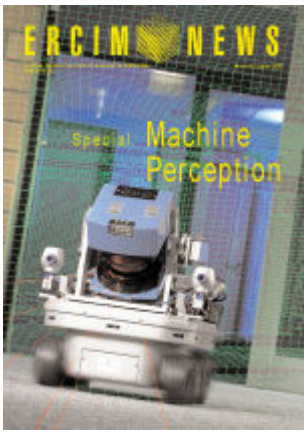
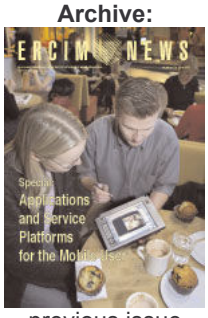
ERCIM NEWS online edition



This issue in pdf
(48 pages; 10,6 Mb)

Free subscription

Archive:



previous issue
Number 54
July 2003:
Special theme:
Applications and Service Platforms for the Mobile User

all previous issues

Next issue:
January 2004

Next Special theme:
Industrial Diagnosis, Planning and Simulation

About ERCIM News

< Contents ERCIM News No. 55, October 2003

R&D AND TECHNOL

A Machine Vision System Controlling the Cutting of A

by Enrico Fantini, Fabio Ganovelli, Paolo Pingi

Based on the integration of image acquisition techniques and real-time systems, system for cutting raw hides has been developed at ISTI-CNR. The aim is to partl cutting process, so that minimal human intervention is needed.

The current procedure for cutting animal hide is completely manual. The hide is spread expert operators decide the best cutting lines on the basis of the location of specific fea manually cut using ad hoc knives and the parts are removed from the bench. The work the most time consuming step, and requires three or four workers.

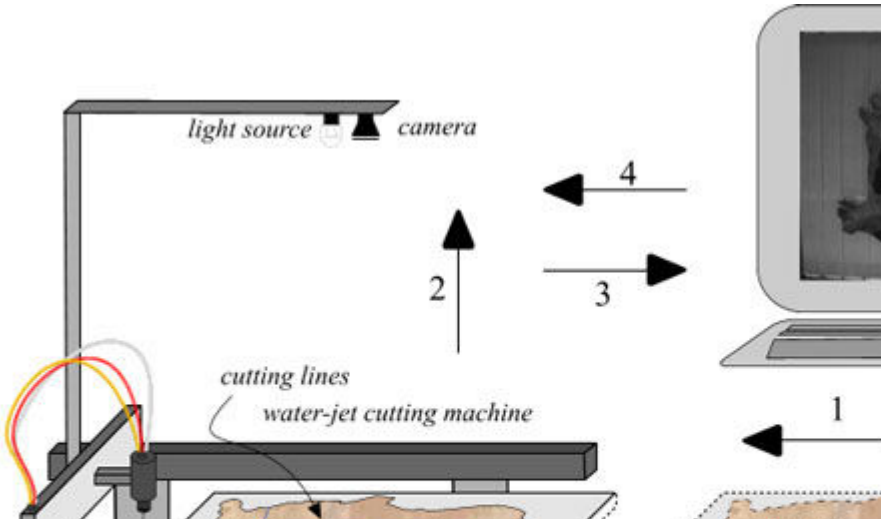
Problem Specifications
Any system to support the cutting of animal skins needs to address the following opera conditions:

- the dimensions of raw hides can vary up to a maximum width and length of 3.5
- the whole process should take less than one minute per hide, which is the time one skilled operator and three assistants
- the cutting system should work within a tolerance of approximately 1cm, measu distance between the cuts performed and the ideal cuts. The error in terms of a 2.0% of the total area - this is the tolerance allowed when the cutting is accomp

There are two main sources of error:

- the animal's coat visibly goes against the grain and either the operator does no and attention on planning the cuts correctly or mistakes are made while cutting
- the ideal cutting lines of the flanks are not arranged symmetrically about the axi is essentially due to the working methodology since, to save time, the skin is fo two cuts at once.

To be commercially competitive, any automatic system must be at least as accurate as possibly faster. The parameters above clearly define these acceptable levels of perfor



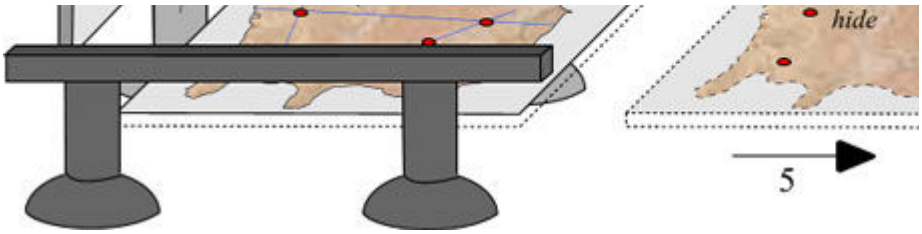


Figure 1: The Cutting System.

System Description
The system work cycle proceeds as follows:

1. The skin is loaded by hand onto a mobile carriage and left unfolded. Reference on the skin and the carriage is started.
2. A picture of the skin is taken by the camera.
3. A computer vision module recognises the skin contour and marker positions an lines.
4. The computed lines are transferred to a numerical control unit which controls th
5. The carriage moves back to its initial position and the skin is unloaded.

Image Acquisition System Specifications
The image acquisition system is composed of a camera with suitable optics positioned light source positioned near the camera, and the frame grabber.

These specifications are defined by the size of the area to be acquired (up to 3.5 by 3.5 height of the camera (at most 4.5m), and the required precision (0.5cm per pixel). The allows these constraints to be met with the introduction of an acceptable distortion to th In the calibration phase, the constants of radial distortion are found, along with the corr the points in the image and the world coordinate. Calibration is only necessary after a h has occurred (eg if the relative position of camera, water-jet machine or carriage have

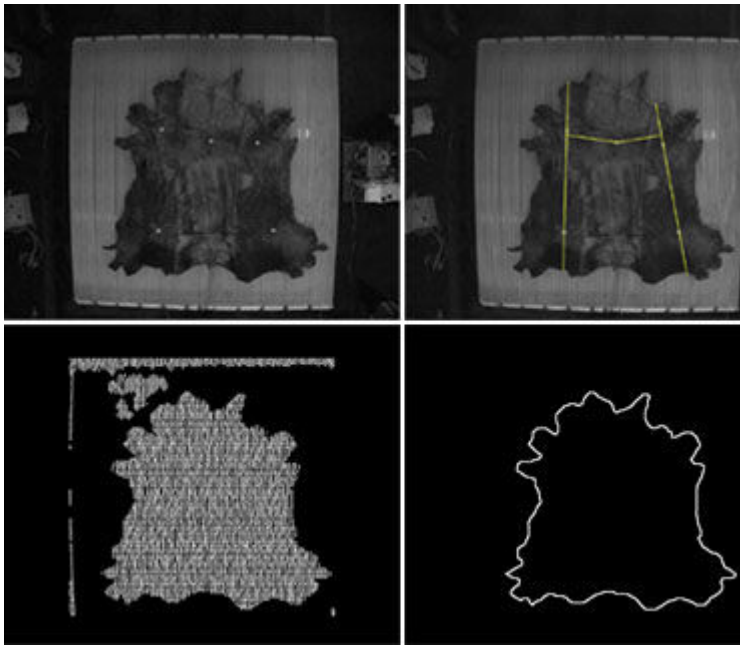


Figure 2: a) The input image; b) Cutting lines; c) detection of inside po d) contour.

Computer Vision Module
This software module takes as its input the image acquired by the camera, and comput These are completely specified by the skin contour and the markers' position.

The markers are round-shaped pieces of common white paper, which show up brightly distinguishable even on white skin. To detect the skin contour is harder because skins size, shape and colour. The software works on the difference between the carriage pla and when the skin is present. More precisely, the carriage plane is made up of many w empty space between the bars allows the water from the water-jet machine to flow awa under the weight of the loaded skin and also become soiled by the skins, pixel-by-pixel

images is not usable. Instead, the system uses an approach loosely based on Snakes
al) to detect the white bars, which are known to be present, and to classify the points w
failed as skin contour. Figure 2 shows the steps of the algorithm.

The process of acquisition and feature detection takes around 5 seconds to be perform
whole cycle is around 30 seconds.

Water-Jet Cutting Machine
The water-jet has a 0.35mm nozzle operating at a cutting pressure of 3 500 bar and a
speed of 30m/min. The cutting bench incorporates specific mechanical modules and th
The system described has been developed in cooperation with C.G.S. Sas - Ricerca S
Pisa, within the framework of an EC project in the IST programme (IST1999-20188).

Please contact:
Paolo Pingi, ISTI-CNR
Tel.:+39 050 315 29 25
E-mail: paolo.pingi@isti.cnr.it