

# Algorithm Helps Read QR Codes on Uneven Surfaces.

Posted by [Okachinepa](#) 10/11/2024



Courtesy of SynEvol  
Credit: Pattern Recognition letters

Sometimes we try to capture a QR code with a good digital camera on a smartphone, but the reading fails. This typically occurs when the QR code is of poor picture quality or has been printed on surfaces that are not flat—deformed or with irregularities of unknown pattern—such as the wrapping of a courier parcel or a tray of prepared food.

Now, a team from the University of Barcelona and the Universitat Oberta de Catalunya has developed a mechanism for recognizing QR codes in physical contexts where reading is more difficult.

The new approach is not entirely dependent on the underlying topography and may be used with QR codes found on tubular surfaces such as bottles and food trays. It is the first technology approach that combines a generalist methodology with two-dimensional barcodes to aid in the recognition of digital data.

QR codes are a type of barcode that, when scanned with a scanning device, can collect information in computer language (a two-dimensional matrix of black and white pixels). They facilitate access to relevant data, save time and resources such as paper, and have transformed how consumers acquire information in the digital arena.

However, it can be difficult to scan a barcode correctly. According to Benito of the UB's Department of Electronic and Biomedical Engineering and former technological director of ColorSensing, this occurs "first and foremost because of the quality of the image. Although many individuals today have access to high-quality digital cameras, they are not always able to capture the QR picture accurately.

"Secondly, the QR code's print quality and the colors used—with good contrast—are not always sufficient. Finally, if the printing surface is not level and parallel to the capture plane, it is difficult to capture the information in the code."

"For example, all of these elements come into play when we try to capture a Bicing QR using the mobile app: The surface is not flat—it is a cylinder—and if we try to capture the QR too close, the deformation of the surface becomes evident and the reading fails—5-10 centimeters; if we move too far away, the QR becomes too small and the capture is not good—1 meter; and if we are in an intermediate range, the apparent distortion of the surface is lowered, and the quality is acceptable for catching it—30-50 centimeters," says Benito.

This work, which is a component of Ismael Benito's doctoral thesis at the UB, proposes a new technique that extracts the underlying surface on which the code is positioned by utilizing the QR's inherent patterns.

This surface's texture is restored using a generalist correction based on splines, which are mathematical functions that enable localized topography adjustment. Benito explains that "they are functions that adapt locally to the ups and downs of the surface, and form a technique that was originally widely used in fields such as geology or photographic editing to adjust or generate deformations in surfaces."

The entire QR code identification process still faces numerous technological obstacles that need to be overcome.

As the expert adds, "the main challenge is to be able to provide correct and reliable readings" in the context of commercial programs that are activated by the user's code reader. Additionally, we are putting a lot of effort into making sure that the codes cannot be compromised by methods of modification, such as using a phony URL that can collect data with only minor code changes."

"In the case of industry, where captures are done in controlled environments, the main challenge is to reduce the speed of capture," Benito states.