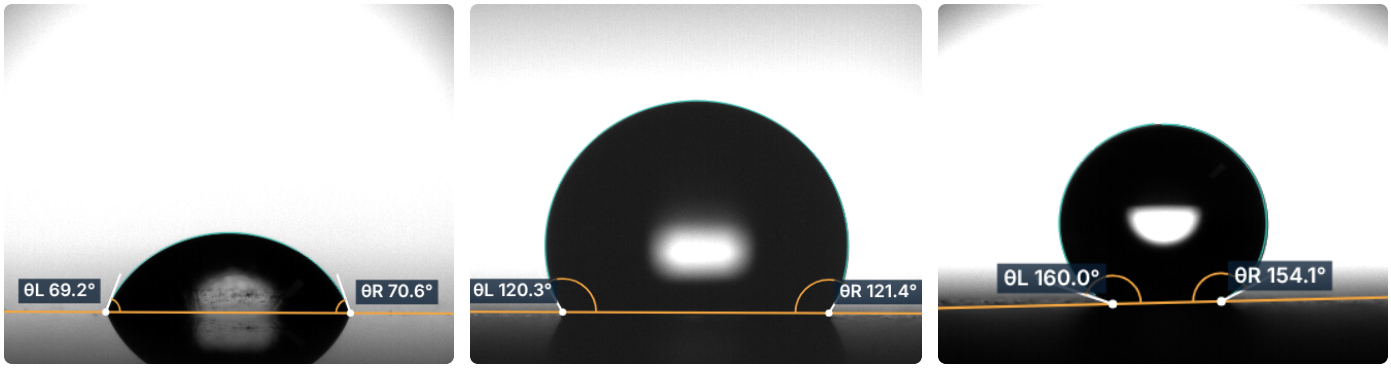
Contact Angle Analyzer: validation on 80 real drop images

A free, browser-based tool that measures left and right contact angles of sessile drops from side-view images. We compared it with two established programs on a published dataset of 80 water-drop photographs.



Hydrophilic surface, about 70° | Hydrophobic, reflective surface, about 121° | Superhydrophobic surface, about 157°

Automatic results of the analyzer on three dataset images (cases 4, 1 and 26; photographs by J.-W. Lee, CC BY 4.0 [1]). Yellow: detected baseline. White: tangent of the fitted drop profile at each contact point.

01 What the analyzer does

- **Edge detection:** the uneven brightness of the backlight is removed, and the drop outline is placed at half contrast with sub-pixel accuracy. The dispensing needle is ignored.
- **Baseline:** found from the contact points themselves, either the corner where the drop meets the substrate or, on reflective surfaces, the neck where the drop meets its reflection.
- **Angle:** by default an axisymmetric Young–Laplace profile, the shape of a drop flattened by gravity, is fitted to the outline. The contact angle is read where the profile meets the baseline. Edge points at the blurred contact line itself are left out. A local tangent fit is available as an alternative.
- **Privacy and records:** images are processed only in the user's browser and never uploaded. The CSV export records every setting, so each result can be reproduced.

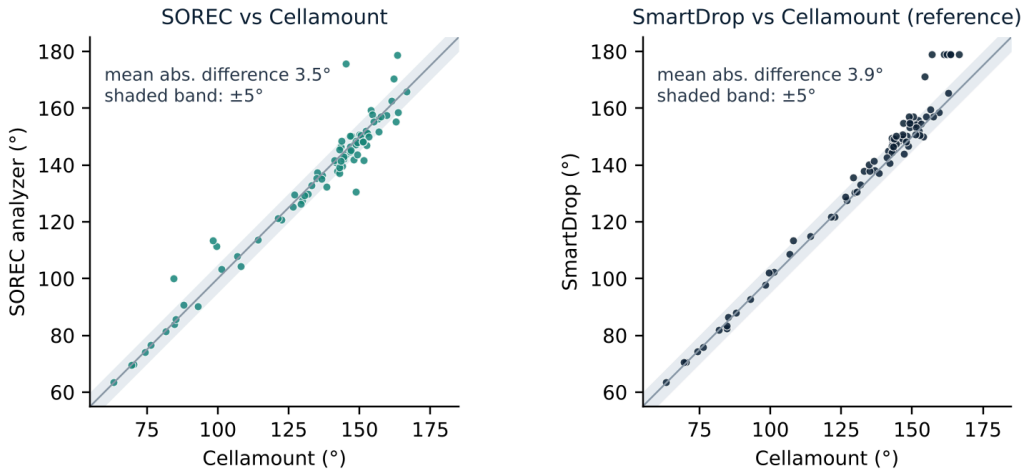
02 Validation data

The dataset [1] contains 80 photographs of water drops (640 × 480 pixels) on surfaces from hydrophilic to superhydrophobic, each measured with SmartDrop, a commercial instrument, and with Cellamount scope PC, an academic program, which both fit Young–Laplace profiles. We analyzed all 80 original images with default settings and no manual correction. The two programs are reference measurements, not the true contact angle: they disagree with each other by 3.9° on average.

03 How to cite

Omeje, I. S. (2026). *SOREC Contact Angle Analyzer* (Version 2.0) [Computer software]. Surface Optimization Research & Consulting (SOREC) LLC, Hattiesburg, Mississippi, USA. https://soreclabs.com/contact-angle.html

04 Agreement with established software



Left: our analyzer against Cellamount. Right: SmartDrop against Cellamount, for scale. Each point is one image (mean of left and right angles).

Drops (SmartDrop angle)	Images	SOREC vs Cellamount	SOREC vs SmartDrop	Cellamount vs SmartDrop
Below 90°	10	2.1°	2.5°	0.7°
90 to 150°	40	4.0°	5.0°	2.6°
150 to 170°	23	2.5°	5.6°	3.5°
Above 170°	7	5.6°	14.1°	16.6°
All	**80**	**3.5°**	**5.7°**	**3.9°**

Values are mean absolute differences. Overall, the analyzer differs from Cellamount by slightly less than the two established programs differ from each other, and 63 of the 80 images agree with Cellamount within 5°. Between 90° and 170° it reads on average about 3° lower than SmartDrop. On synthetic images with known angles, blurred and with camera noise, the mean error was 0.8° for spherical drops, 1.5° for gravity-flattened drops and 2.2° for small, noisy drops.

05 Known limits

- **Unclear substrate line:** on 5 of the 80 images the automatic baseline was placed too high or too low, giving errors of 10° or more. The baseline can then be corrected by hand; a one-pixel shift changes a high angle by about one degree.
- **Angles above 170°:** the contact point is almost hidden, and the established programs disagree with each other by up to 20°. Such values should be reported with care.
- **Image quality:** small drops (under about 200 pixels wide), poor focus or strong reflections on the edge reduce accuracy, and the tool warns about them. It measures the apparent angle in the image plane; rough or patterned surfaces need several drops and viewing directions.

Need more than a measurement? SOREC models how surfaces interact with liquids, from the molecular to the continuum scale: wetting of laser-textured and coated surfaces, droplet impact and spreading, and icing. We also analyze droplet image series and impact videos for research groups.
Try the analyzer at soreclabs.com/contact-angle.html · Contact sorecllc@gmail.com

[1] J.-W. Lee, "Paired sessile-drop contact angle measurements and analysis images from 80 water-droplet photographs", Mendeley Data, V1 (2026), doi:10.17632/t25zyc857h.1, licensed CC BY 4.0. Example images are reproduced from this dataset with the analyzer's overlay added.