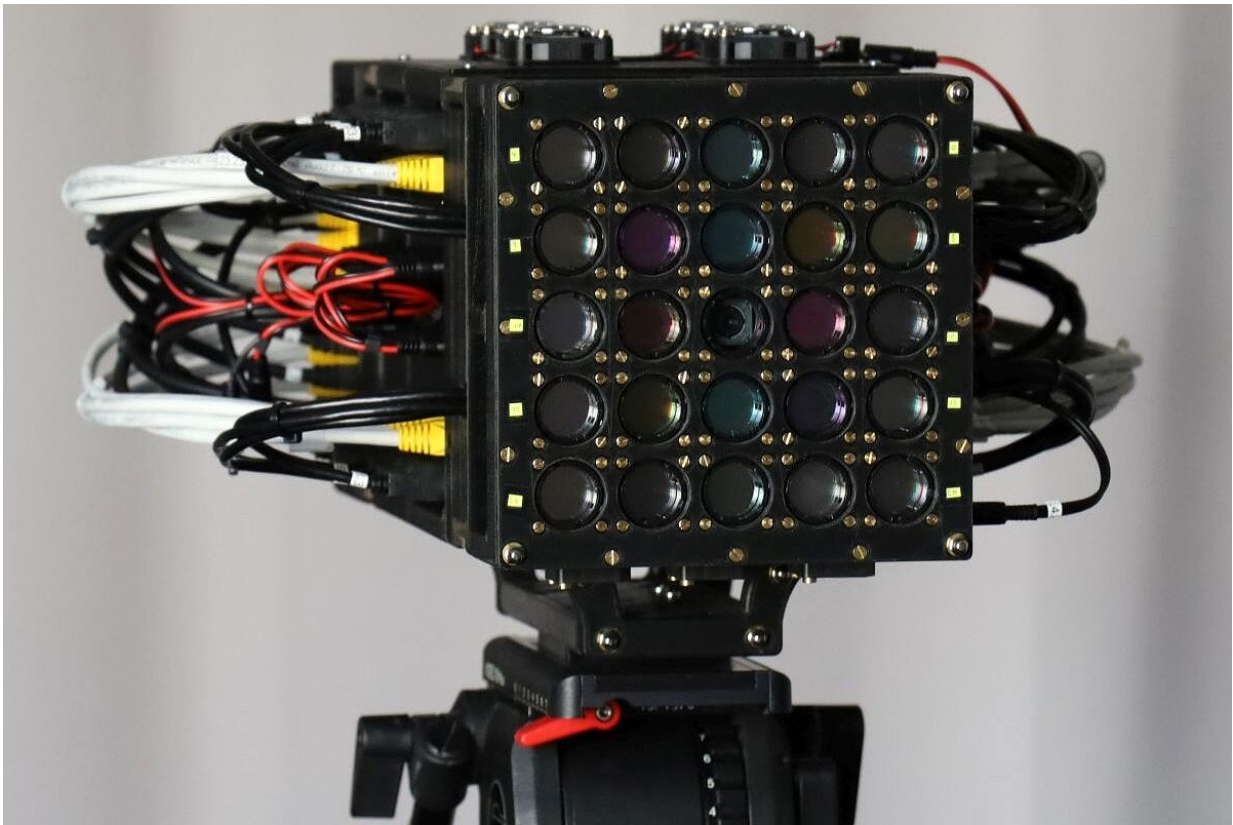


# Team develops cost-efficient and high-resolution multi-spectral camera

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The prototype of the high-resolution multi-spectral camera developed by a research team at the Chair of Multimedia Communications and Signal Processing at FAU: 5x5 cameras combine spatial, temporal and spectral resolution. Credit: FAU/Nils Genser

A team of researchers at the Chair of Multimedia Communications and

Signal Processing at Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU) has developed an intelligent camera that achieves not only high spatial and temporal but also spectral resolution. The camera has a wide range of applications that can improve environmental protection and resource conservation measures as well as autonomous driving or modern agriculture. The findings of the research have been published as an open access publication.

"Research up to now has mainly focused on increasing spatial and [temporal resolution](#), which means the number of megapixels or images per second," explains lecturer Dr. Jürgen Seiler. "Spectral resolution—the wavelength and thus the perception of colors—has largely been adjusted to match human sight during the development of cameras, which merely corresponds to measuring the colors red, green and blue. However, much more information is hidden in the light spectrum that can be used for a wide range of tasks. For example, we know that some animals use additional light spectra for hunting and searching for food."

## **Three resolutions in one camera**

Seiler, who is an [electrical engineer](#), has developed a high-resolution multi-spectral camera that enhances human perception with his team at the Chair of Multimedia Communications and Signal Processing (LMS) led by Prof. Dr. Kaup at FAU. It combines all three resolutions—spatial, temporal and spectral—in a cost-efficient solution. "Up to now, there were only extremely expensive and complex methods for measuring the ultraviolet or infrared ranges of light or individual spectral bands for special industrial applications," says Seiler. "We looked for a cost-efficient model and we were able to develop a very cost-effective multi-spectral camera."

The researchers connected several inexpensive standard cameras with

various spectral filters to form a multi-spectral camera array. "We then calculated an image in order to combine the various spectral information from each sensor," explains Nils Genser, research associate at LMS. "This new concept enables us to precisely determine the materials of each object captured using just one single image."

At the same time, the new camera is greatly superior to existing systems in terms of its spatial, temporal and [spectral resolution](#). As the surroundings are recorded by several "eyes" as is the case with human sight, the system also provides a precise indication of depth. This means that the system not only precisely determines the color and certain material properties of objects it captures, but also the distance between them and the camera.

## **Ideal for autonomous driving and environmental technology**

Autonomous driving is a potential application for these new intelligent cameras. "A whole range of solutions to various problems has now opened up thanks to our new technology," says Seiler. "In the infrared range, for example, we can differentiate between real people and signposts using the thermal signature. For night driving, we can detect animals crossing the road with sufficient warning."

The high-[resolution](#), multi-spectral cameras could also be used for protecting the environment and conserving resources. "Several plastics differ significantly from each other in various ranges of the spectrum, which is something the new intelligent [camera](#) can reliably detect," Genser emphasizes. "Large amounts of plastics are simply burned instead of separated for recycling as they have a similar appearance. We can now separate them reliably."

**More information:** Nils Genser et al, Camera Array for Multi-Spectral Imaging, *IEEE Transactions on Image Processing* (2020). [DOI: 10.1109/TIP.2020.3024738](https://doi.org/10.1109/TIP.2020.3024738)

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