

Intelligent 3-D human modelling technology projects body shape and size accurately within 10 seconds

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The innovation allows a customised model in arbitrary dynamic poses to be created automatically within 5-10 seconds. Credit: The Hong Kong Polytechnic University

Buying well-fitting clothes online or making bespoke garments is easier with intelligent 3-D human modeling technology developed by The Hong Kong Polytechnic University (PolyU). The software digitally reconstructs the shape and size of a person accurately from two full body photographs within five to 10 seconds. This PolyU innovation, developed by Dr. Tracy P.Y. Mok, associate professor, and Dr. Zhu Shuaiyin, Ph.D., from PolyU, can solve the problem of ill-fitting clothes and enhance the online shopping experience.

Existing methods have known limitations and involve expensive and bulky scanners and too much approximation, and therefore are of questionable accuracy. By integrating cutting-edge computer graphic and vision technology, this innovation generates a customised model in arbitrary dynamic poses in seconds. The system can reconstruct the 3-D shape and extract over 50 size measurements of different parts of an individual, including accurate measurements of chest, waist, hip, thigh, knee, calf and neck, as well as arm length, and shoulder slope. The discrepancies in tight-fitting and loose-fitting clothing are less than 1 cm and 2 cm respectively, which are precise enough for the specific requirements of the clothing industry for fashion applications and comparable to body scans.

Four methods were developed to realise automatic shape modelling of individuals by:

1. detecting body parts in tight fitting clothing from front-view and side-view 2-D images and then construct them to 3-D models;
2. predicting under-the-clothes body profiles of the subjects based on input images where the body profiles are covered in arbitrary clothing, including tight-fitting, normal-fitting and loose-fitting clothing;
3. applying cutting-edge deep learning technology to segmentise the human body image from the background. It also improves the

robustness, efficiency and accuracy of shape modelling of individuals;

4. applying the above modelling methods to develop a client-server system. It is a mobile application of the automatic shape customisation technology, starting from photo taking to model customization and size extraction:

<https://itunes.apple.com/us/app/1measure/id1234853015?mt=8>

https://play.google.com/store/apps/details?id=com.tozmart.imeasure&hl=zh_HK

These methods are enabled by Big Data analytics, in which a large dataset with over 10,000 human scan models were used to analyse local 3-D shape features and predict under-the-clothes body profiles.

Different from other existing methods that analyse 3-D scans globally, PolyU's research team decomposes the data yielded from a 3-D scan into local features for data analysis. The team then predicts and assembles the 2-D and 3-D shapes of subjects based on 2-D photographs. The resulting 3-D models have precisely reconstructed both global and local shape characteristics of individuals, and accurate body measurements can be extracted from these customised models.

The digital reconstruction of human subjects can provide competitive advantages for the fashion industry. "With an accurate projection of the size and shape of the human body, these customised models will enhance online shopping experience, and stimulate growth in fashion online shopping," said Dr. Mok.

"The output models can also enable customers to visualise try-on effects before purchases in online stores. This frees us from the limitations imposed by taking body measurements physically, helping customers to select the right size in online clothing purchases," added Dr. Zhu.

Commercialisation of the technology

With the support from Shanghai Technology Entrepreneurship Foundation-PolyU China Entrepreneurship Fund, Dr. Zhu has set up the start-up, TOZI, in Shenzhen in 2017 to commercialise and further develop the 3-D human modelling technology, echoing PolyU's commitment to foster culture that boosts entrepreneurship and inspires entrepreneurs.

Based on the intelligent 3-D human modelling technology, TOZI has collaborated with Industry 4.0 factories to launch a brand-new customer-to-manufacturer (C2M) service for customers. It brings unmatched online shopping experience to end users by empowering them to order tailor-made clothing within just three minutes anywhere anytime. By a few clicks on smartphones, customers can measure their own shape and size, and order tailored made shirts, with a range of fabrics, collars, pockets, cuffs, front plackets to choose from.

Provided by Hong Kong Polytechnic University

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