Detection of Polyps in Colonoscopy

Team

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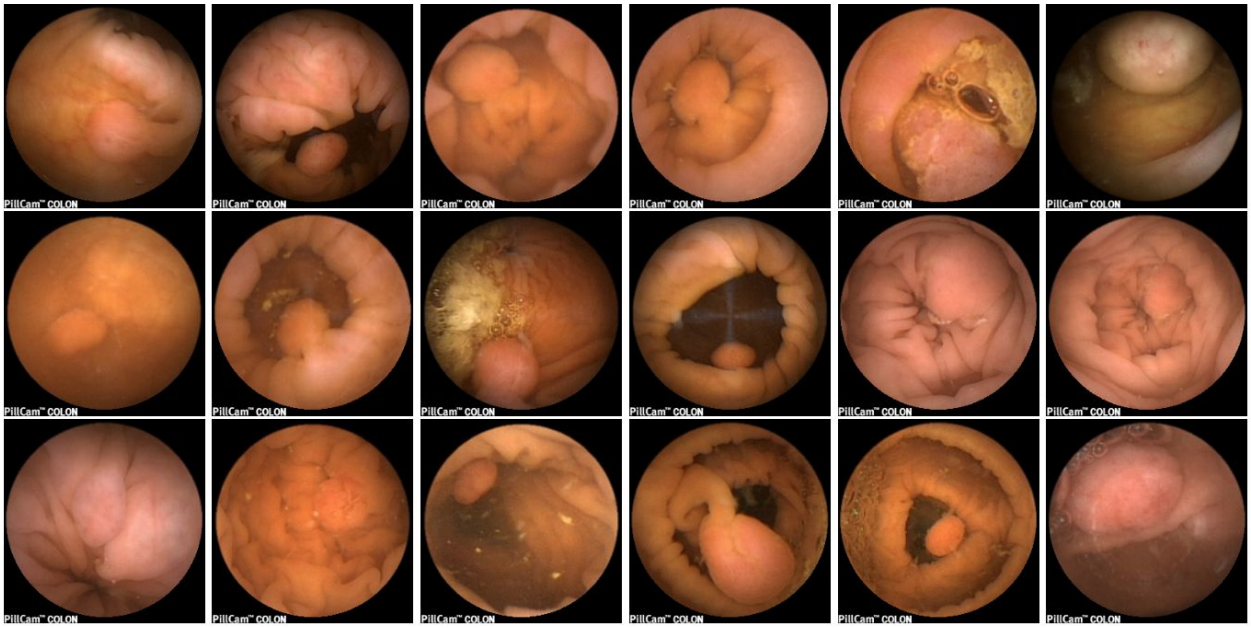
Problem Statement

A colon polyp is a small clump of cells that forms on the lining of the colon. Most colon polyps are harmless. But over time, some colon polyps can develop into colon cancer, which is often fatal when found in its later stages. Video capsule endoscopy (VCE) is used widely nowadays for visualizing the gastrointestinal (GI) tract. Capsule endoscopy exams are prescribed usually as an additional monitoring mechanism and can help in identifying polyps, bleeding, etc. Video capsule endoscopy (VCE) is an innovative diagnostic imaging modality in gastroenterology, which acquires digital photographs of the gastrointestinal (GI) tract using a swallowable miniature camera device with LED flash lights. The capsule transmits images of the gastrointestinal tract to a portable recording device. The captured images are then analyzed by gastroenterologists, who locate and detect abnormal features such as polyps, lesions, bleeding, etc. and carry out diagnostic assessments. A typical capsule exam consists of more than 50,000 images, during its operation time, which spans a duration of 8 to 10h. Therefore, it is obvious that a more efficient way to estimate and assess the formation of polyps and lesions would be to develop an automated pipeline which can function on the output of the VCE and produce accurate results. Detecting polyps from VCE imagery is one of the foremost problems in devising automated computer-aided detection and diagnosis systems. The polyps to be detected in the images are characterized by physicians according to human perception of their distinctive shapes, and also in some cases, by their color and texture in these geometric objects. With large availability of medical data, it has become easier to devise automatic pipelines to automate these tasks which would otherwise take many hours.

Throughout the literature, many different works have been devised to perform such a task, but most of those have been classical vision techniques which brute force an approach to fit an X patient's data and have little to no generalization. Since polyps differ largely in geometry and size, therefore a pipeline which is scale and geometry invariant is required to automate the task of detection. With the recent advent of deep neural networks, the problems of feature engineering and geometrical learning have been solved to a large extent due to the capacity of convolutional neural networks to learn abstractions up the hierarchy.

Variability of Polyps in Colon



Solution

The team is comprised of three members: Muhammad Kamran Janjua, Raja Hasnain Anwar and Ali Hassan Mughal. The whole pipeline is divided into three major tasks and each of them is distributed to each team member: devise classical techniques to detect the landmark in VCE, devise a CNN based pipeline to segment out the poylps from the gastrointestinal tract.

One of the most interesting aspects of this project is that we can devise an interface which can take the VCE results as input and provide real-time feedback on polyp detection from the GI. Furthermore, the project can be deployed in any environment where colonoscopic polyps are to be detected and segmented. To save the labor of 8-10h, automated techniques can help to reach the results faster. We plan to deliver it either via a command line interface or a GUI where the user can upload images and get the detection results. The dataset that will be used for this project is a polyp-grand challenge [1] and Kvasir Landmark and Pathological Classification Dataset [2].

Since we all are interested in the medical aspect of deep learning, we chose this project to learn more about how medicine can be transformed with the application of deep neural networks [3].

References

[1] https://polyp.grand-challenge.org/
[2] https://datasets.simula.no//kvasir/
[3] Polyp Detection and Segmentation