In this work we investigate （一般现在，研究）the effect of the convolutional network depth on its accuracy in the large-scale image recognition setting.

Our main contribution is（一般现在，be动词） a thorough evaluation of networks of increasing （动名词，增长）depth using（动名词，使用） an architecture with very small (3×3) convolution filters, which shows（一般现在，展示） that a significant improvement on the prior-art configurations can be achieved（被动形式，达到） by pushing（动名词，推） the depth to 16–19 weight layers.

These findings were（过去式，be动词） the basis of our ImageNet Challenge 2014

submission, where our team secured（过去式，保卫） the first and the second places in the localisation and classification tracks respectively.

We also show（一般现在，展现） that our representations generalise（一般现在，泛化） well to other datasets, where they achieve（一般现在，达到） state-of-the-art results.

We have made（现在完成时，使得） our two best-performing ConvNet models publicly available to facilitate further research on the use of deep visual representations in computer vision.

Convolutional networks (ConvNets) have recently enjoyed（现在完成时，享有） a great success in large-scale image and video recognition (Krizhevsky et al., 2012; Zeiler & Fergus, 2013; Sermanet et al., 2014; Simonyan & Zisserman, 2014) which has become（一般现在时，变成） possible due to the large public image repositories, such as ImageNet (Deng et al., 2009), and high-performance computing systems, such as GPUs or large-scale distributed clusters (Dean et al., 2012).

In particular, an important role in the advance of deep visual recognition architectures has been played（现在完成时的被动语态，展现） by the ImageNet Large-ScaleVisual Recognition Challenge (ILSVRC) (Russakovsky et al., 2014), which has served（现在完成时，应用） as a testbed for a few generations of large-scale image classification systems, from high-dimensional shallow feature encodings (Perronnin et al., 2010) (the winner of ILSVRC-2011) to deep ConvNets (Krizhevsky et al., 2012) (the winner of ILSVRC-2012).

With ConvNets becoming more of a commodity in the computer vision field, a number of attempts

have been made（现在完成时的被动语态，制作） to improve the original architecture of Krizhevsky et al. (2012) in a bid to achieve better accuracy.

For instance, the best-performing submissions to the ILSVRC-2013 (Zeiler & Fergus, 2013; Sermanet et al., 2014) utilised（一般过去时，使用） smaller receptive window size and

smaller stride of the first convolutional layer.

Another line of improvements dealt with（一般现在时，处理） training and testing the networks densely over the whole image and over multiple scales (Sermanet et al.,2014; Howard, 2014).

In this paper, we address（一般现在时，引用） another important aspect of ConvNet architecture

design – its depth.

To this end, we fix（一般现在时，修饰） other parameters of the architecture, and steadily increase（一般现在时，增加） the depth of the network by adding more convolutional layers, which is（一般现在时，be动词） feasible due to the use of very small (3 × 3) convolution filters in all layers.

As a result, we come up with （一般现在时，提出）significantly more accurate ConvNet architectures, which not only achieve（一般现在时，达到） the state-of-the-art accuracy on ILSVRC classification and localisation tasks, but are（一般现在时，be动词） also applicable to other image recognition datasets, where they achieve（一般现在时，达到） excellent performance even when used（一般过去时，使用） as a part of a relatively simple pipelines (e.g. deep features classified by a linear SVM without fine-tuning).

We have released（现在完成时，释放） our two best-performing models1 to facilitate further research.

The rest of the paper is organised（一般现在时被动，组织） as follows.

In Sect. 2, we describe（一般现在时，描述） our ConvNet configurations.

The details of the image classification training and evaluation are then presented（一般现在时被动，展现动词） in Sect. 3, and the configurations are compared（一般现在时被动，比较） on the ILSVRC classification task in Sect. 4.

Sect. 5 concludes（一般现在时，包括） the paper.

For completeness, we also describe（一般现在时，描述） and assess（一般现在时，解释） our ILSVRC-2014 object localisation system in Appendix A, and discuss（一般现在时，讨论） the generalisation of very deep features to other datasets in Appendix B.

Finally, Appendix C contains（一般现在时，包含） the list of major paper revisions.