**I n t r o d u c t io n**

Automatic food recognition is an emerging research topic not only for the social network domain aspect. Indeed, researchers are focusing on this area because of its increasing benefits for medical point of view. Automatic food recognition tools will help in facilitating the decision-making process of calories estimation, quality detection of food, build diet monitoring systems to combat obesity and so on [1].

On the other hand, food is inherently deformable and shows high divergence in appearance. Since food images have high intraclass variance and low inter-class variance due to which classic approaches do not recognize complex features. This makes food recognition a difficult task for which complex features are not recognized by classic approaches. CNNs can easily identify these features automatically, thus increasing classification accuracy [2]. Therefore, this paper attempts to use CNNs for food image classification. Fig. 1 shows images looking very similar to each other but both images belong to different food classes.

This is due to low inter class variance among food items. Convolution Neural Network has basically three layers: convolution layers, pooling layers and fully connected layers. Convolution layer assigns learnable weights and biases to input image. Pooling layer down-samples the input data by summarizing the features thus reducing trainable parameters. At the end fully connected layer is present having full connections to all neurons. Softmax activation function calculated the probability of the image belonging to a particular class. Since food images have high intraclass variance and low inter-class variance due to which some of the complex features are not recognized by Machine Learning methods, but CNNs can easily identify these complex features. These network models based upon deep learning has achieved significant success by automatically discovering very highlevel features, thus increasing classification accuracy. Therefore, the proposed work intends to use CNNs for food image classification. These networks extract features automatically by applying convolution operation in certain layers on the input data using a convolution filter to produce a feature map. These networks contain millions of parameters and their training needs a huge amount of data and high computational resources. Hence, researchers preferred utilizing pre-trained networks by fine-tuning on domainspecific data. Knowledge learned by the pre-trained models can be utilized on related data using the transfer learning approach [3]. In this paper, food image classification has been investigated using SqueezeNet and VGG-16 models of CNN. These are pre-trained networks trained on more than a million images of the ImageNet dataset consisting of 1000 classes. The learned weights and features from pre-trained deep convolution neural networks have been used in SqueezeNet and VGG-16 on the Food-101 dataset through transfer learning. To classify image traditional techniques and deep learning techniques are used. Through traditional techniques only basic features of images like color, shape, texture [4] etc. can be detected. Classical machine learning algorithms like support vector machine (SVM) [5], random forests [6] and

artificial neural networks [7] can also be implemented for image classification with lesser accuracy compared to deep learning methods. With deep learning techniques deep and complex features can be identified easily making recognition task better. Deep learning techniques like convolution neural network (CNN), transfer learning, data augmentation and deep feature fusion network are used widely [8].