**1) For the MSCOCO paper, identify and describe each of the crowdsourcing microtasks (in 1-3 sentences per microtask) that are used in the complete crowdsourcing system pipeline to segment objects. [6 points]**

**Ans.** The different crowdsourcing tasks that are used in the complete crowdsourcing system pipeline to segment objects are:

1. Category Labeling

In category labeling task, we first determine the object categories that are present in any given image. Next, instead of asking binary classification question to crowd-workers; a hierarchical approach is used in which the existing object categories are grouped into eleven different super object categories. The crowd workers were asked to identify whether any given image had instances from the super category. It is done by dragging the category icon into the image over the instance of that category. To ensure high accuracy eight crowd workers are asked to label each given image with a restriction that each worker labels just one instance of a category.

1. Instance Spotting

After identifying the instances of the object categories present in an image, we label these instances. Since an image may have multiple object instances, it is important to identity these instances as well. To accomplish this, the worker were instructed to use a cross symbol over the instances of a specific category that was found during the category labeling step. Now, it becomes easy for the next worker that works on that image to identify other small instances of the same category. The workers were asked to label a maximum of ten instances of a given category.

1. Instance Segmentation

In this stage the workers are asked to segment the instances of an object, which were identified by crowd workers in the previous step. The worker can see if the image has other instances that have already been segmented. The workers also have an option to indicate that an image has no object instance of a given category or all the instances of that object have already been segmented. The workers were trained to identify the object category by completing training tasks. An image segmentation verification step was included by asking multiple workers to judge each instance segmentation.

**2) For the "Utility Data Annotation" paper, describe each of the crowdsourcing approaches (in 1-3 sentences per approach) for protocols 1-3; i.e., there should be three descriptions in your response. [9 points]**

**Ans.** The different annotation protocols are

1. There are 2 Object Segmentation Protocol

* First - Object Segmentation Protocol

In this object segmentation protocol, the crowd worker is given an original image and a small image of the query for example query can be the image of a person. In the next step the worker are asked to identify the query- person by clicking on small circles site that overlaps with the query (person). It can be seen from fig1.that the protocol places the sites on the regular grid.

* Second - Object Segmentation Protocol

In this object segmentation protocol, the crowd worker is given an original image and a small image of the query for example query can be the image of a person. In the next step the worker are asked to identify the query- person by clicking on small circles site that overlaps with the query (person). The fig. 1 shows that the protocol uses the superpixels of the image and places sites at the center of the superpixels of the query-person.

2. Polygonal Labeling

* In polygonal labeling, the crowd workers are given an interface in which they are asked to draw a boundary around a person in the image. The boundary selection is done by adding a label to the selected object/person along with a shape around the selected person.

3. 14-point human landmark labeling

* This protocol is mainly used for labeling the landmarks of the human body used for pose annotation. The workers are asked to click on location of 14 predefined points which are right ankle, right knee, right hip, left hip, left knee, left ankle, right wrist, right elbow, right shoulder, left shoulder, left elbow, left wrist, neck and head. (Sorokin,2008, p.2).The workers are continuously notified of the next landmark. It captures the movement of body parts of any person in the image using the human landmark (14 points).

**3) Choose one of the crowdsourcing systems you discussed from questions 1 and 2, and describe two ways that you would improve the crowdsourcing system. [5 points]**

**Ans.** In the “Utility Data Annotation” paper, the protocol 14-point human landmark labeling mentions that the user needs to select all the 14 point in a specified order.

* In my opinion, it should not be mandate for the crowd workers to select all the specified points (14), as it may happen sometime that a person is sitting or standing in such a position that it becomes difficult for crowd workers to identify the left and right counterparts of body.
* We can also first ask the crowd worker to draw an outline around the targeted object/person in the image and then ask for selecting the human landmark, this would improve the segmentation accuracy.

**[5 points] In addition, please submit one  "discussion point'' in total (not per paper).  This can be in the form of  a question, critique, connection to other readings, or plausible future work that you think is interesting to investigate in greater detail in class.  The discussion point may be about one paper or can compare and contrast different papers.  In addition, the discussion point can address the proposed idea, methods, experimental design, and analysis of results.  This should be roughly 1 sentence.**

**Ans.** In the “Utility Data Annotation” paper, the paper discusses 4 different types of annotation protocol. I would like to discuss the advantages of each protocol and the specific use case scenario for these protocols.