

Using Crypto-currency and smart contracts to pay citizen scientists

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Mapping land use in Africa (30.22 million km²) at a resolution of 250m²; requires the annotation of 500 million images (480 if you want to be pedantic but probably below 400 excl Sahara). If 1000 correctly annotated images were required to earn a \$ (assuming 3 secs to annotate = \$ hr) and each image was analysed three times then the whole of Africa could be land use mapped for \$1.5 million. Just 10,000 contributors could do it in under 3 months. .. OK once you factored everything in then that could double but even \$3 million for a continental map is astonishingly cheap...

1) Mappers would register.

Each mapper would get an id and an associated payment wallet on registration.

The wallet would be used to receive payments but would have a lock on minimum withdrawal

(i.e 1\$)* this would encourage participants to complete a minimum number of tasks on a given project ..

* other locks could limit the receipts/balances/withdrawals as a fraud prevention measure

2) Registered user would select a project to participate in

Images held in a pool (database1) are randomly called to be annotated by the registered user once annotated the the image is returned to the pool and another image is called to be annotated this repeats always giving the registered user a new random image from the same project.

3) Every image called a minimum of three times for annotation by three different users (database1)

Once the image has been called and annotated three times the three annotations would be compared and if identical (within given parameters) the image would be deemed to have been correctly annotated and moved to a completed pool (database3).

The three wallets associated with the registered ids are credited

If not then the image would be returned to the pool(database1) to be annotated a fourth time.

If three of the four annotations are the same the incorrect annotation will be dropped and the image moved to the completed pool (database3)

The three wallets associated with the registered ids are credited

If three of the four are not annotated the same, the image will be flagged and moved to a priority pool.(database2)

Payment for annotating to be triggered by image being moved to database3

All three annotators receive payment.

4) Where there is discrepancy the image is moved to a research database where it can be checked by a project researcher. Any incorrect annotations can be deleted the image moved to database three and registered id wallets paid. If only one is correct or none appropriate action should be taken by the researcher before correctly annotating the image and moving it to database3.

below is my idea of the above in code/steps ..

```
# get image from database1
# get annotation (Ax)
# count annotations
  # if less than three
    # return to pool
  # if equal to three
    # sum ( (A1-A2) + (A1-A3) + (A2-A3) )
    # if equal 0
      # mark A1, A2, A3 accepted
      # pay accepted id wallets
      # put in database3
    # if sum not equal 0
      # return image to database1
  # if equal to four
    # sum ( (A1-A2) +(A1-A4) + (A2-A4)** )
    # if equal 0
      # mark A1, A2, A4 accepted
      # mark A3 rejected
      # pay accepted id wallets
      # put image in database3
    #if sum not equal 0
      # sum ( (A1-A3) + (A1-A4) + (A3-A4)** )
      # if sum equal 0
        # mark A1, A3, A4 accepted
        # mark A2 rejected
        # pay accepted id wallets
        # put image in database3
      #if sum not equal 0
        # sum ( (A2-A3) + (A2-A4) + (A3-A4)** )
        # if sum equal 0
          # mark A2, A3, A4 accepted
          # mark A1 rejected
          # pay accepted id wallets
          # put image in database3
        #if sum not equal 0 put in database2
  # if greater than four put in database2
```

This should result in images being moved from database1 to database3 acquiring either 3 positive (paid) annotations or 3 positive and one negative (unpaid) annotation on the way.. everything else should end up in database2 to be scrutinized further.

**note its likely all three subtractions are not nec to ascertain the sum is 0, if 2 are correct the third must also be.

Database2 and database3 hold a lot of information about both the project and the mappers
Analysis of rejected annotations in db2 and db3 will reveal rogue mappers who accumulate more rejections; these could be ignored and the annotations again compared.. this would throw up images which would have passed at the first count had the rogue mapper not annotated... these images can be

moved to database3 and the correct annotations paid. The remaining images in database2 are likely to be ambiguous in some way and so require further scrutiny by a researcher.

The advantage of what I'm proposing here is it will lead to improved accuracy and efficiency in mapping. Whilst the comparison method will be a little more complex Citizen Science projects which require annotation or shading on an image can be significantly improved by putting both payment and rejection into the equation... nothing like 'the money' to motivate the bored and [sadly] desperate. Its a shit old world.....

Any comments Welcome

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