WAYS OF MACHINE SEEING[1]

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You are looking at the front cover of the book Ways of Seeing written by John Berger in 1972. The text is the script of the TV series, and if you've seen the programmes, you can almost hear the distinctive pedagogic tone of Berger's voice as you read his words: "The relation between what we see and what we know is never settled."[2]

The image by Magritte on the cover further emphasises the point about the deep ambiguity of images and the always-present difficulty of legibility between words and seeing.[3] In addition to the explicit reference to the "artwork" essay by Walter Benjamin,[4] the TV programme employed Brechtian techniques, such as revealing the technical apparatus of the studio; to encourage viewers not to simply watch (or read) in an easy way but rather to be forced into an analysis of elements of "separation" that would lead to a "return from alienation".[5] Berger further reminded the viewer of the specifics of the technical reproduction in use and its ideological force in a similar manner: "But remember that I am controlling and using for my own purposes the means of reproduction needed for these programmes [...] with this programme as with all programmes, you receive images and meanings which are arranged. I hope you will consider what I arrange but please remain skeptical of it."

That you are not really looking at the book as such but a scanned image of a book — viewable by means of an embedded link to a server where the image is stored — testifies to the ways in which what, and how, we see and know is further unsettled through complex assemblages of elements. The increasing use of relational machines such as search engines is a good example of the ways in which knowledge is filtered at the expense of the more specific detail on how it was produced. Knowledge is now produced in relation to planetary computational infrastructures in which other agents such as algorithms generalise massive amounts of (big) data.[6]

Clearly algorithms do not act alone or with magical (totalising) power but exist as part of larger infrastructures and ideologies. Some wellpublicised recent cases have come to public attention that exemplify a contemporary politics (and crisis) of representation in this way, such as the Google search results for "three black teenagers" and "three white teenagers" (mug shots and happy teens at play, respectively).[7] The problem is one of learning in its widest sense, and "machine learning" techniques are employed on data to produce forms of knowledge that are inextricably bound to hegemonic systems of power and prejudice.

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There is a sense in which the world begins to be reproduced through computational models and algorithmic logic, changing what and how we see, think and even behave. Subjects are produced in relation to what algorithms understand about our intentions, gestures, behaviours, opinions, or desires, through aggregating massive amounts of data (data mining) and machine learning (the predictive practices of data mining).[8] That machines learn is accounted for through a combination of calculative practices that help to approximate what will likely happen through the use of different algorithms and models. The difficulty lies in to what extent these generalisations are accurate, or to what degree the predictive model is valid, or "able to generalise" sufficiently well. Hence the "learners" (machine learning algorithms), although working at the level of generalisation, are also highly contextual and specific to the fields in which they operate in a coming together of what Adrian Mackenzie calls a "play of truth and falsehood".[9]

Thus what constitutes knowledge can be seen to be controlled and arranged in new ways that invoke Berger's earlier call for skepticism. Antoinette Rouvroy is similarly concerned that algorithms begin to define what counts for knowledge as a further case of subjectivation, as we are unable to substantively intervene in these processes of how knowledge is produced.[10] Her claim is that knowledge is delivered "without truth" through the increasing use of machines that filter it through the use of search engines that have no interest in content as such or detail on how knowledge is generated. Instead they privilege real-time relational infrastructures that subsume the knowledge of workers and machines into generalised assemblages as techniques of "algorithmic governmentality".[11]

a Pelican Original

WAYS OF SEEING

Based on the BBC television series with

JOHN BERGER

comes before words. It is seeing which establishes our place

in the surrounding world; we explain that world with words

but words can never undo the fact that we are surrounded by

it. The relation between what we see and what we know is

on this always-present gap between words and seeing in

The way we see things is affected by what we

//

a painting called The Key of Dreams.

and recognizes before it can speak.

Seeing comes before words. The child looks

But there is also another sense in which seein

In this sense, the knowledge produced is bound together with systems of power that are more and more visual and hence ambiguous in character. And clearly computers further complicate the field of visuality, and ways of seeing, especially in relation to the interplay of knowledge and power. Aside from the totalizing aspects (that I have outlined thus far), there are also significant "points of slippage or instability" of epistemic authority, [12] or what Berger would no doubt identify as the further unsettling of the relations between seeing and knowing. So, if algorithms can be understood as seeing, in what sense, and under what conditions? Algorithms are ideological only inasmuch as they are part of larger infrastructures and assemblages.

But to ask whether machines can see or not is the wrong question to ask, rather we should discuss how machines have changed the nature of seeing and hence our knowledge of the world.[13] In this we should not try to oppose machine and human seeing but take them to be more thoroughly entangled — a more "posthuman" or "new materialist" position that challenges the ontoepistemological character of seeing — and produces new kinds of knowledge-power that both challenges as well as extends the anthropomorphism of vision and its attachment to dominant forms of rationality. Clearly there are other (nonhuman) perspectives that also illuminate our understanding of the world. This pedagogic (and political) impulse is perfectly in keeping with Ways of Seeing and its project of visual literacy.[14] What is required is an expansion of this ethic to algorithmic literacy to examine how machine vision unsettles the relations between what we see and what we know in new ways.

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Notes

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[1] The title of this paper is taken from a workshop organized by the
                        // Recognize text on an image using Tesseract API and print
                                                                                      cambridge Digital Humanities Network, convened by Anne Alexander,
                        // Usage: ./tess image.png
                                                                                      Alan Blackwell, Geoff Cox and Leo Impett, and held at Darwin College,
                                                                                      University of Cambridge, 11 July 2016,
                        #include
                                                                                      http://www.digitalhumanities.cam.ac.uk/Methods/waysofmachineseeing
                        #include
                        #include
                                                                                      [2] Ways of Seeing, Episode I (1972), https://www.youtube.com/watch?
                        #include
                                                                                      v=opDE4VX9Kk. The 1972 BBC four-part television series of 30-minute
                        #include
                                                                                      films was created by writer John Berger and producer Mike Dibb.
                        #include "opencv2/core/core.hpp"
                        #include "opency2/features2d/features2d.hpp"
                                                                                      Berger's scripts were adapted into a book of the same name, published
                                                                                      by Penguin also in 1972. The book consists of seven numbered essays:
                        #include "opencv2/highgui/highgui.hpp"
                        #include "opencv2/imgproc/imgproc.hpp"
                                                                                      four using words and images; and three essays using only images. See
                                                                                      https://en.wikipedia.org/wiki/WaysofSeeing.
                                                                                      [3] René Magritte, _The Key of Dreams (1930),
                             j namespace cv;
                                                                                      https://courses.washington.edu/hypertxt/cgi-
                                                                                      bin/book/wordsinimages/keydreams.jpg. Aside from the work of
                             namespace std;
                                                                                      Magritte, Joseph Kosuth's One and Three Chairs (1965) comes to mind,
                                                                                      that makes a similar point in presenting a chair, a photograph of the
                             nain(int argc, char** argv)
                                                                                      chair, and an enlarged dictionary definition of the word "chair",
                                                                                      https://en.wikipedia.org/wiki/OneandThreeChairs.
                              .f (argc < 2)
                                                                                      [4] The first section of the programme/book is acknowledged to be
                                                                                     largely based on Benjamin's essay "The Work of Art in the Age of
                                 std::cout << "Please specify the input image!" << std:</pre>
                                                                                      Mechanical Reproduction" (1936),
                                 return -1;
                                                                                      https://www.marxists.org/reference/subject/philosophy/works/ge/benja
                                                                                      [5] The idea is that "separation" produces a disunity that is disturbing
                                 char *outText;
                                                                                      to the viewer/reader — Brecht's "alienation-effect" (Verfremdungeffekt)
                             .nt fontface = FONT_HERSHEY_SIMPLEX;
                             :esseract::TessBaseAPI *api = new tesseract::TessBaseAPI();— and that this leads to a potential "return from alienation". See
                              // Initialize tesseract-ocr with English, without specifyingthess/datavilabedia.org/wiki/Distancingeffect.
                              f (api->Init(NULL, "deu")) {
                                                                                      [6] To give a sense of scale and its consequences, Facebook has
                                 fprintf(stderr, "Could not initialize tesseract.\n");
                                                                                      developed the face-recognition software DeepFace. With over 1.5 billion
                                                                                      users that have uploaded more than 250 billion photographs, it is
                                                                                      allegedly capable of identifying any person depicted in a given image
                                                                                      with 97% accuracy. See
                              // Open input image with leptonica library
                                                                                      https://research.facebook.com/publications/deepface-closing-the-gap-
                             'ix *image = pixRead(argv[1]);
                                                                                      to-human-level-performance-in-face-verification/.
                             // fat im=imread(argv[1],CV_LOAD_IMAGE_COLOR);
                                                                                      [7] Antoine Allen "The 'three black teenagers' search shows it is society,
                             int icols=im.cols;
                                                                                      not Google, that is racist", The Guardian (10 June 2016),
                             int irows=im.rows;
                                                                                      https://www.theguardian.com/commentisfree/2016/jun/10/three-black-
                             :v::Mat wim( irows, icols, im.type(), cv::Scalar(0));
                                                                                      teenagers-google-racist-tweet. [8] Adrian Mackenzie, "The Production
                             Rect letterRect;
                                                                                      of Prediction: What Does Machine Learning Want?," European Journal
                             Mat src, dst, color_dst;
                                                                                      of Cultural Studies, 18, 4-5 (2015): 431.
                             .nt confidence_level=0;
                                                                                      [9] Mackenzie, "The Production of Prediction", 441.
                             .nt j=0;
                             ;rc=imread(argv[1],CV_LOAD_IMAGE_GRAYSCALE);
                                                                                      [10] See, for instance, Antoinette Rouvroy's "Technology, Virtuality and
                                                                                      Utopia: Governmentality in an Age of Autonomic Computing", in The
                             lanny(src, dst, 50, 200, 3 );
                              cvtColor( dst, color_dst, CV_GRAY2BGR );
                                                                                      Philosophy of Law Meets the Philosophy of Technology: Computing and
                                                                                      Transformations of Human Agency, eds. Mireille Hildebrandt and
                               Antoinette Rouvroy (London: Routledge, 2011), 136-157.
                                                                                      [11] This line of argument is also close to what Tiziana Terranova has
                                 size_t i = 0; i < lines.size(); i++ )</pre>
                                                                                      called an "infrastructure of autonomization", making reference to
                                Marx's views on automation, particularly in his "Fragment on double Angle = atan2(lines[i][3]- lines[i][1], lines[i][2] lines[i][0]) * 180.0 / CV PI; machines subsume the knowledge
                                 if(Angle>=0 && Angle <=5){
                                                                                      and skill of workers into wider assemblages. Tiziana Terranova, "Red
                                     numlines++;
                                                                                      Stack Attack! Algorithms, capital and the automation of the common",
                                    line( color_dst, Point(lines[i][0], lines[i][1]),
     ESSE OF THE BED SENSOR SENSOWER
                                                                                      Effimera (2014), accessed August 24, 2016, http://effimera.org/red-
                                          Point(lines[i][2], lines[i][3]), Scalar(0,0
                                                                                      stack-attack-algorithms-capital-and-the-automation-of-the-common-
                                                                                      di-tiziana-terranova/.
                                                                                      [12] Mackenzie, "The Production of Prediction", 441.
                             if(numlines>40){
                                                                                      [13] I take this assertion from Benjamin once more, who considered the
                                       screen=cvCreateMat(im.rows,im.cols,im.type());
                                                                                      question of whether film or photography to be art secondary to the
                                       ★Image(image);
                                                                                      question of how art itself has been radically transformed:
                                          oanize(0):
         mide and the man surgifier stores to which ender
                                                                                      "Earlier much futile thought had been devoted to the question of
             le is sure to with an eld is the conduction
          g worder we haven a transmitted with
                                          ::ResultIterator* ri = api->GetIterator();
                                                                                      whether photography is an art. The primary question — whether the
                                           Ta sign to Carrie on With Ma sag and With Ma Brown
                                                                                      was not raised. Soon the film theoreticians asked the same ill-
                                if (ri != 0) {
                                                                                      considered question with regard to film."
                                    do {
                                                                                      https://www.marxists.org/reference/subject/philosophy/works/ge/benja
                                         const char* word = ri->GetUTF8Text(level);
                                        float conf = ri->Confidence(level);
                                                                                      [14] Berger was associated with The Writers and Readers Publishing
                                         int x1, y1, x2, y2;
                                                                                      Cooperative, aiming to "advance the needs of cultural literacy, rather
                                         ri->BoundingBox(level, &x1, &y1, &x2, &y2);
                                          word, conf, x1, y1, x2, y2);
                                                                                      cultural materialism of Raymond Williams and Richard Hoggart's The
                                         bool ignore;
                                                                                      Uses of Literacy (1966).
                                         int psize, fid;
                                        ri->WordFontAttributes(&ignore,&ignore,&ignore,&ignore,&ignore,&ignore,&psize,&fid);
                                                      printf("point size: %d font id: %d",psize, fid);
                                         if(conf>50){
                                            QString utfw = QString::fromUtf8(word);
                                               if(utfw.size()>4){
                                                    printf("word: '%s' \tlength: %d\n",word,utfw.length());
                                                letterRect=CvRect();
                                                letterRect.x=x1;
                                                letterRect.y=y1;
                                                letterRect.width=(x2-x1);
                                                letterRect.height=(y2-y1);
                                                Mat letterim;
                                                try{
                                                    letterim=im(letterRect).clone();
                        //
                                                      im.copyTo(wim(Rect(letterRect.x, letterRect.y, letterRect.width, letterRect.height)));
```

cv::Rect roi(cv::Point(letterRect.x, letterRect.y), cv::Size(letterRect.width, letterRect.height));

printf("cols %d rows %d\n",wim.cols,wim.rows);

cv::Mat destinationROI = wim(roi); letterim.copyTo(destinationROI);

printf("x %d y %d width %d height %d \n",letterRect.x, letterRect.y,letterRect.width, letterRect.height);

```
QString qs = QString("words/word_%1_").arg(word);
 //
                                                  qs.append(QString("%1.jpg").arg(j));
imwrite(qs.toStdString(),letterim);
 //
                                         catch( cv::Exception& e )
                                               const char* err_msg = e.what();
                                                  std::cout << "exception caught: " << err_msg << std::endl;</pre>
 //
                                        rectangle(wim,Point(x1, y1),Point(x2,y2),Scalar(255,0,0),1,8);
putText(wim,word,Point(x1,y1),fontface,0.5,CV_RGB(255,0,0), 1, 8);
confidence_level+=conf;
                                         j++;
                            //}
                    delete[] word;
} while (ri->Next(level));
// printf("OCR output:\n%s", outText);
// printf("num lines: %d \n",numlines);
// printf("num symbols: %d \n",j);
// printf("confidence level: %d \n",confidence_level);
       if(numlines>40){
    printf("%d\n",(confidence_level/j));
               imwrite(argv[2],wim);
        }else{
              printf("%d\n",0);
imwrite(argv[2],wim);
// namedWindow( "Detected Lines", 1 );
// imshow( "Detected Lines", color_dst );
// imshow( "Result", im);
// imshow( "Wim", wim);
// imwrite("words.jpg",wim);
 // waitKey();
  // Destroy used object and release memory
     api->End();
// delete [] outText;
pixDestroy(&image);
        return 0;
```