Learnings from developing and maintaining a research software that has been used more than 3 million times in the last 3 years

Dr. Abhishek Dutta

adutta@robots.ox.ac.uk Senior Research Software Engineer, University of Oxford

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Our Vision



• Develop, maintain and support computer vision research software that are widely used in multiple academic disciplines and industrial sectors.

Our Vision



- Develop, maintain and support computer vision research software that are widely used in multiple academic disciplines and industrial sectors.
- Nurture an open source ecosystem around these software tools to ensure sustainability and lasting impact.

... that, to pursue our vision, our research software tools should be:

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In this talk, I will share how the development of a manual annotation tool has been a valuable learning experience for us.



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Easy to install and setup

- An anecdote from 2016: A DPhil student from our lab spent several hours to install a manual annotation software in the Mac laptop of another DPhil student from the Humanities department. The manual annotation tool was essential for a collaborative project about visual search of images.
- Being a Computer Vision lab, we required a manual annotation tool for almost every project to develop datasets for training computer vision algorithms. Therefore, in mid 2016, we decided to build our own manual annotation software* because the existing tools:
 - required complex installation and setup procedure, and
 - they were not easy to use for non-technical users (e.g. students from Humanities, Anthropology, History, etc.).



* VGG Image Annotator https://www.robots.ox.ac.uk/~vgg/software/via/

Our requirements were very simple to state but complex to deliver:

- Up and running in less than a minute
- Easy to use for non-technical users

As we explored our options, we stumbled upon the HTML/CSS/Javascript offline application platform offered by all browsers.

```
<html>
<head>
 <title>VGG Image Annotator version 0.0.1</title>
 <stvle>
   div { position:relative; }
   canvas { position:absolute; top:0; left:0;}
 </stvle>
</head>
<bodv>
 <div>
   <img id="image" src="./swan.ipg">
   <canvas id="regions">Browser not supported</canvas>
 </div>
 x0,y0,x1,y1
 <script>
   var r = document.getElementById('regions'); // top region layer
   var im = document.getElementById('image'); // bottom image layer
   im.addEventListener('load', function() {
     r.width = im.width; r.height = im.height; // fit layers
   });
   var ctx = r.getContext('2d', {alpha:true}); // draw context
   var x0, y0, x1, y1;
                                              // coordinates
   var v = document.getElementById('view'); // export panel
   r.addEventListener('mousedown', function(e) {
     x0 = e.offsetX; y0 = e.offsetY; // top-left
   });
   r.addEventListener('mouseup', function(e) {
     x1 = e.offsetX; y1 = e.offsetY; // bottom-right
     ctx.strokeRect(x0, y0, x1 - x0, y1 - y0); // draw
     v.innerHTML += '\n' + x0 + ',' + y0 + ',' + x1 + ',' + y1;
   });
 </script>
</body>
</html>
```

A minimal manual annotation tool in 34 lines of HTML/CSS/Javascript.

```
<html>
<head>
 <title>VGG Image Annotator version 0.0.1</title>
 <stvle>
   div { position:relative; }
                                                                                                             <canvas ... >
   canvas { position:absolute; top:0; left:0;}
 </stvle>
</head>
<bodv>
 <div>
   <img id="image" src="./swan.ipg">
   <canvas id="regions">Browser not supported</canvas>
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                                                                                                              <img ... >
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     x1 = e.offsetX; y1 = e.offsetY; // bottom-right
     ctx.strokeRect(x0, y0, x1 - x0, y1 - y0); // draw
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   });
 </script>
</body>
</html>
```

```
<html>
<head>
 <title>VGG Image Annotator version 0.0.1</title>
 <stvle>
                                                  Ensures that the canvas
   div { position:relative; }
                                                                                                                <canvas ... >
   canvas { position:absolute; top:0; left:0;}
                                                  layer is above the image
 </stvle>
</head>
<bodv>
 <div>
   <img id="image" src="./swan.ipg">
   <canvas id="regions">Browser not supported</canvas>
 </div>
 x0,y0,x1,y1
 <script>
                                                                                                                 <img ... >
   var r = document.getElementById('regions'); // top region layer
   var im = document.getElementById('image'); // bottom image layer
   im.addEventListener('load', function() {
                                                                    Ensures that the size of canvas is same as
     r.width = im.width; r.height = im.height; // fit layers
                                                                    the size of the image
   });
   var ctx = r.getContext('2d', {alpha:true}); // draw context
   var x0, y0, x1, y1;
                                                // coordinates
   var v = document.getElementById('view');
                                             // export panel
   r.addEventListener('mousedown', function(e) {
     x0 = e.offsetX; y0 = e.offsetY;
                                           // top-left
   });
                                                                    Records the locations of mouse events and
   r.addEventListener('mouseup', function(e) {
                                                                    uses it to draw rectangular bounding boxes.
     x1 = e.offsetX; y1 = e.offsetY;
                                               // bottom-right
     ctx.strokeRect(x0, y0, x1 - x0, y1 - y0); // draw
     v.innerHTML += '\n' + x0 + ',' + y0 + ',' + x1 + ',' + y1;
   });
 </script>
</body>
</html>
```

Easy to install and setup

- In the last four years, we have been extending this minimal manual annotation tool in multiple ways to build several self contained offline HTML applications for image and video annotation.
 - Full application fits in a single HTML file < 400KB
 - Offline application that runs in any web browser
 - Up and running in less than a minute by simply opening the HTML file in web browser

Index of file:///home/tlm/via_demo/

✤Up to higher level directory

Name	Size	Last Modified					
🗉 via_image_annotator.html	390 KB	09/11/2020	13:21:48 GMT				
🗉 via_subtitle_annotator.html	294 KB	30/10/2020	10:23:38 GMT				
🗉 via_video_annotator.html	394 KB	09/11/2020	13:16:27 GMT				

Demo

Easy to install and setup

- Someone has to spend the time:
 - It can be either the users who collectively spend countless hours in installing and setup
 - or, it can be the developer who spends certain amount of time to make the process frictionless and quick.
- It is not a difficult decision.

- easy to install and setup,
- easy to use,
- easy to fix, modify and extend.





• By using it everyday.



- By using it everyday.
- Talk to people who use it.



- By using it everyday.
- Talk to people who use it.
- Act on what you see and hear.



• Users are already familiar to standard HTML components

- Minimalism and simplicity guides all our decisions
- We only use the browser behaviours that are consistent across all web browsers
- Concise user guide at the bottom of screen.

Screenshot of VIA Image Annotator



Screenshot of VIA Subtitle Annotator

- We have built this tool from ground up and therefore we have the flexibility to:
 - · Handle our events
 - Draw our graphics
 - Build ...
- Before our tools are released, a lot of people (mostly researchers) test these tools.



- Video annotation is just as easy as image annotation.
- Keyboard shortcuts helps get manual annotation done faster.

Screenshot of VIA Video Annotator

- It helps to have a User Experience (UX) developer in your team to develop easy to use and intuitive user interfaces.
- Since we didn't have a UX developer in our team, we learned the art using online resources:
 - User Interface Design and Implementation (MIT OCW)
 - Material Design System
 - Smashing Magazine
 - ...

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Easy to fix, modify and extend

- Our users not only report issues but also often contribute code to fix those issues.
- We don't minify* our JS code to allow our users to easily fix, modify and extend our tools.



* process of removing all unnecessary characters (commonly added for readability of the code) from the source code without changing its functionality.

Easy to fix, modify and extend

- We don't depend on external libraries or frameworks:
 - You only need to know about core Javascript to work with our code.
 - Our code does not need anything other than a standard web browser.
 - Therefore, we can fit everything in less than 400KB.
- We are always exploring ways to write code that improves human understanding. We want you to fix, modify and extend our code.

_via_temporal_segmenter.prototype._vtimeline_time2canvas = function(t) { return Math.floor(((this.vtimelinew * t) / this.m.duration) + this.padx);

via_temporal_segmenter.prototype._vtimeline_canvas2time = function(x) {
 var t = ((x - this.padx) / this.vtimelinew) * this.m.duration;
 return Math.max(0, Math.min(t, this.m.duration));

via_temporal_segmenter.prototype._vtimeline_mark_draw = function() {
 var time = this.m.currentTime;
 var cx = this._vtimeline_time2canvas(time);

// clear

this.vtimeline_mark_ctx.font = '16px Mono'; this.vtimeline_mark_ctx.fillStyle = 'white'; this.vtimeline_mark_ctx.fillRect(0, 0,

this.vtimeline_mark.width,
this.vtimeline_mark.height);

// draw arrow

```
this.vtimeline_mark_ctx.fillStyle = 'black';
this.vtimeline_mark_ctx.beginPath();
this.vtimeline_mark_ctx.moveTo(cx, this.linehn[2]);
this.vtimeline_mark_ctx.lineTo(cx - this.linehb2, this.lineh);
this.vtimeline_mark_ctx.lineTo(cx + this.linehb2, this.lineh);
this.vtimeline_mark_ctx.moveTo(cx, this.linehn[2]);
this.vtimeline_mark_ctx.fill();
```

// draw current time

this.vtimeline_mark_ctx.fillText(tstr, tx, this.linehn[2] - 2);

Easy to fix, modify and extend

Issues · Visual Geometry Group / via · GitLab · Mozilla Fi	irefox + _ !
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유 🛱 📩 📩 Edit issues New issue	
Open 114 Closed 204 All 318	
Recent searches ~ Search or filter results	
Last updated \checkmark 17	
Coco import convert some of bboxes polygon shape	60
#298 - opened 3 months ago by Yakup Akkaya	updated 2 days ago
project key undefined when attempting to pull changes using VPS #319 · opened 2 days ago by Tristan	口 0 updated 2 days ago
Issue loading previously exported JSON File #318 - opened 6 days ago by Alberto Gómez	CLOSED 🛱 1 updated 6 days ago
[VIA3] Undo and redo feature for video annotation #317 · opened 6 days ago by Abhishek Dutta (Feature Requests)	0 اللہ updated 6 days ago
VIA3: resizing region with zoom activated in image annotator fails to remove old regio #316 · opened 1 week ago by Abhishek Dutta (Bug Report)	updated 1 week ago
IIIF compliance #315 - opened 2 weeks ago by jean-philippe moreux	2 updated 2 weeks ago
Support for Web Annotation format?	G 2
#170 - opened 1 year ago by Giles Bergel (Feature Requests)	updated 2 weeks ago
cannot export to coco format #314 - opened 2 weeks ago by HK autoplant2	3 updated 2 weeks ago
COCO export doesn't export the bounding boxes annotation #311 - opened 3 weeks ago by Sara Battiston	لا 🛱 updated 2 weeks ago
"Default Path" issue in Windows #313 - opened 2 weeks ago by Abhishek Dutta Bug Report	0 ایا updated 2 weeks ago
category id still missing in exported ison files and COCO format ison files in V 2.0.9	CLOSED 👙 🗗 1 🛱 15

	Merge Requests · Visual Geometry Group /	via · GitL	ab -	Mozill	a Fire	fox		- 1	• >
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- 9	Visual Geometry Group > 🚔 via > Merge Requests								
	Edit merge requests New merge request								
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D	Recent searches v Search or filter results								
n	Created date \checkmark 47								
≡-	Fix importing of rectangle regions from COCO files					N	MERGED	C 12	
·ç	!26 · opened 2 days ago by Matthieu Maitre					updat	ed 2 day	rs ago	
0	Fixed coco annotations 125 · opened 7 months ago by Adrian Boguszewski					updated	7 month	哈 0 is ago	
\$	Fix image shortcuts in select-all case					undated	0 month	內0	
ш	24 Opened 9 months ago by Kyan Powier					upuateu	9 110/111	is ago	
රීස්	III: Proposed Fix to Ellipse COCO Annotations calculation 123 - opened 1 year ago by mlubega					updat	ed 1 yes	ir ago	
¢	Implement extreme clicking box annotation					Ν	MERGED	内1	
	122 · opened 1 year ago by Achal Dave					updat	ed 1 yea	ar ago	
	Packing bugfix: Create dist and dist/demo dirs if necessary					١	MERGED	G 3	
	121 · opened 1 year ago by Achal Dave					updat	ed 1 yea	ar ago	
	Make top_panel stick to top							Q0	
	120 · opened 1 year ago by Simon Brugman					updat	ed 1 yea	arago	
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	19 · opened 1 year ago by Simon Brugman					updat	ed 1 yea	ar ago	
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https://gitlab.com/vgg/via/-/merge_requests

We have nurtured an open source ecosystem around our software tools to help our users fix, modify and extend our code.

https://gitlab.com/vgg/via/-/issues

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Of course, there should be a demand for the functionality that the tools are delivering.









VIA suite of tools have been used more than

3,944,000 times

since its public release in 2017.



Thank You

VIA Software Page https://www.robots.ox.ac.uk/~vgg/software/via/ VIA Code Repository https://gitlab.com/vgg/via LISA Code Repository https://gitlab.com/vgg/lisa