



From Vision to System: Prototyping with Ease

Isaac J. Galvan – Product Owner for Illinois App, Technology Services

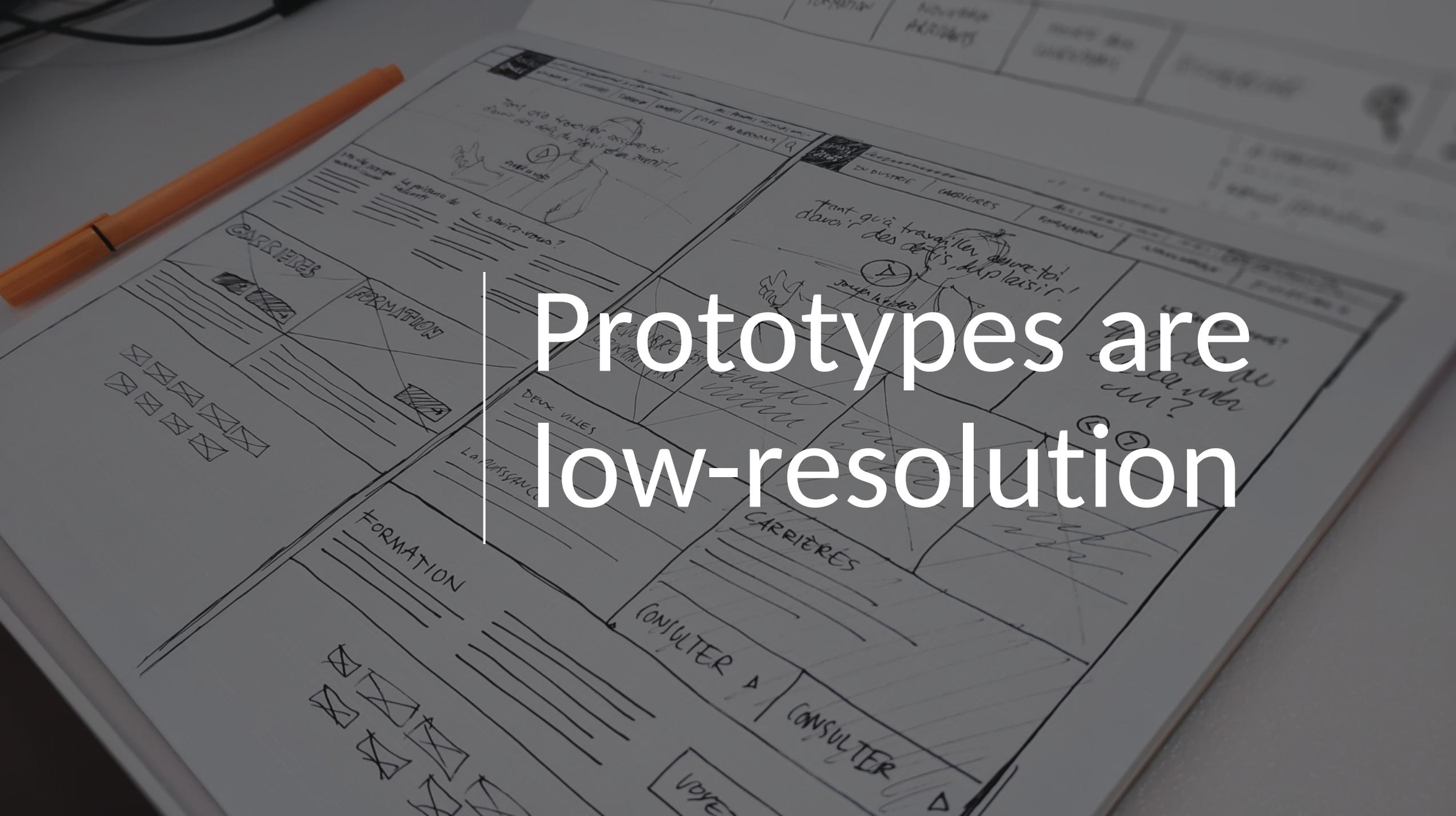
Bradly Alicea – Community Manager, ROKWIRE



Prototypes are
conversation
starters

Prototypes
are one of a
kind



The image shows a top-down view of a notebook page with several hand-drawn wireframe sketches. An orange marker lies on the left side of the page. The sketches are organized into a grid of rectangular panels. Some panels contain text in French, such as "GARRIÈRES", "FORMATION", "DEUX VILLES", "CARRIÈRES", "CONSULTER", and "VOYER". Other panels contain handwritten notes and drawings, including a person's profile and the phrase "tant qu'à travailler assure-toi d'avoir des défis, du plaisir!". The sketches are drawn with black ink and include various lines, boxes, and arrows, representing a low-resolution prototype of a user interface.

Prototypes are
low-resolution

Illinios Podcasts

Experience the podcasts of Illinois. An app for rapid prototyping.

Creating a prototype

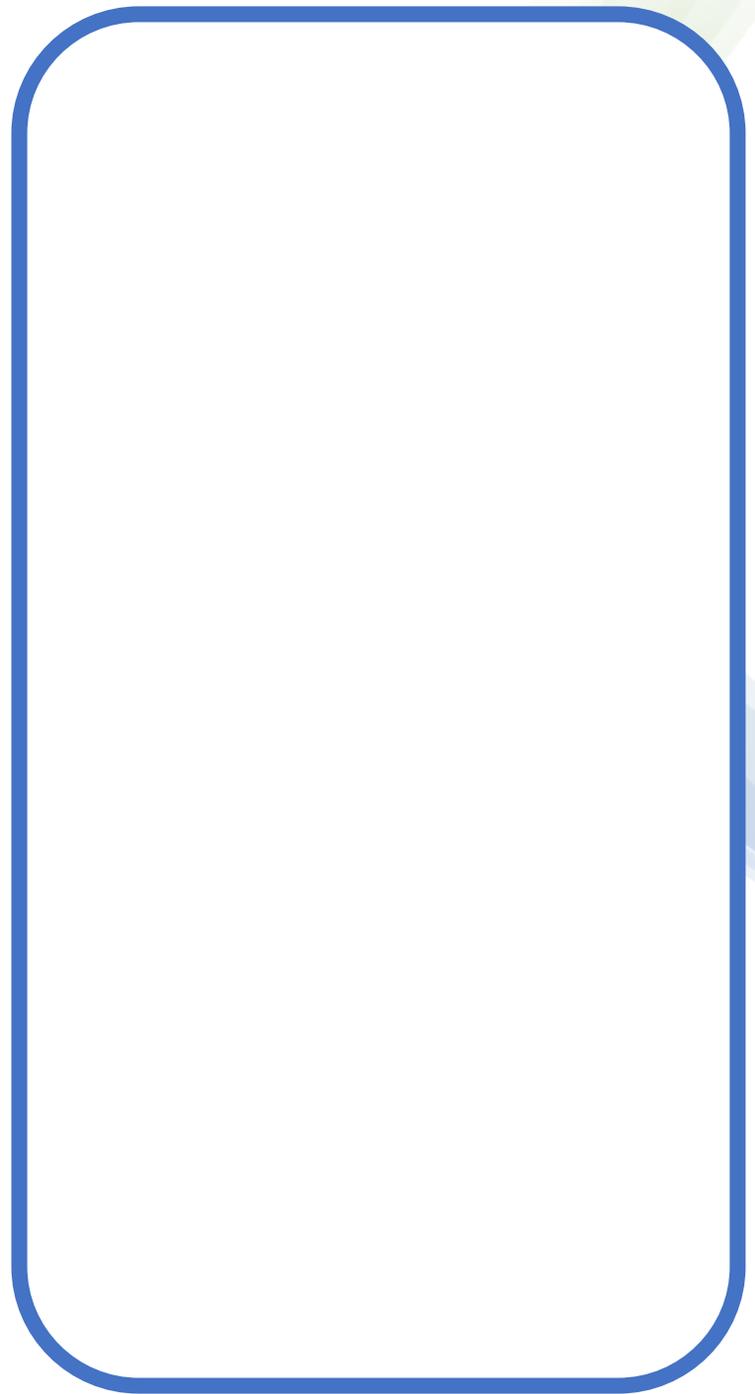


A photograph of a university campus in autumn. The scene is dominated by large, mature trees with thick trunks and dense canopies of yellow and orange leaves. A paved walkway runs through the center, with several people walking. In the foreground, a person in a red jacket and black backpack walks towards the right. Other people are scattered throughout the scene, some walking and some standing. In the background, a large, multi-story building with a green roof and white windows is visible. The overall atmosphere is calm and scenic, typical of a university campus in the fall.

The User Story

As a university community member, I want to discover podcasts created at Illinois so I can learn about the exciting going-ons on campus.

The Canvas



Illinois Podcasts

All Podcasts

One More Time
Illinois Bands

Family Financial Feuds
University Extension

Rising to the Challenge
U of I System

Illinois Innovators
College of Engineering

Inside Fighting Illini Athletics
Fighting Illini

#askACES
College of ACES

Environmental Almanac
WILL

Illinois Podcasts

Producers

WILL
University Extension
College of Engineering
All Producers

All Podcasts

Out Standing in the Field
Natural daily
Wellness Daily
All Colleges

Illinois Podcasts

Producers

WILL	College of Engineering
University Extension	Illinois Public Media
All Producers	

Illinois Podcasts

All Podcasts

One More Time Illinois Bands
Family Financial Feuds University Extension
Rising to the Challenge U of I System
Illinois Innovators College of Engineering
Inside Fighting Illini Athletics Fighting Illini
#askACES College of ACES
Environmental Almanac

Illinois Podcasts



Outstanding in the
Field
Episode 42: Something



Rising to the Challenge
Episode 2: Key Choices



Wellness Daily
Episode 123
November 8, 2020

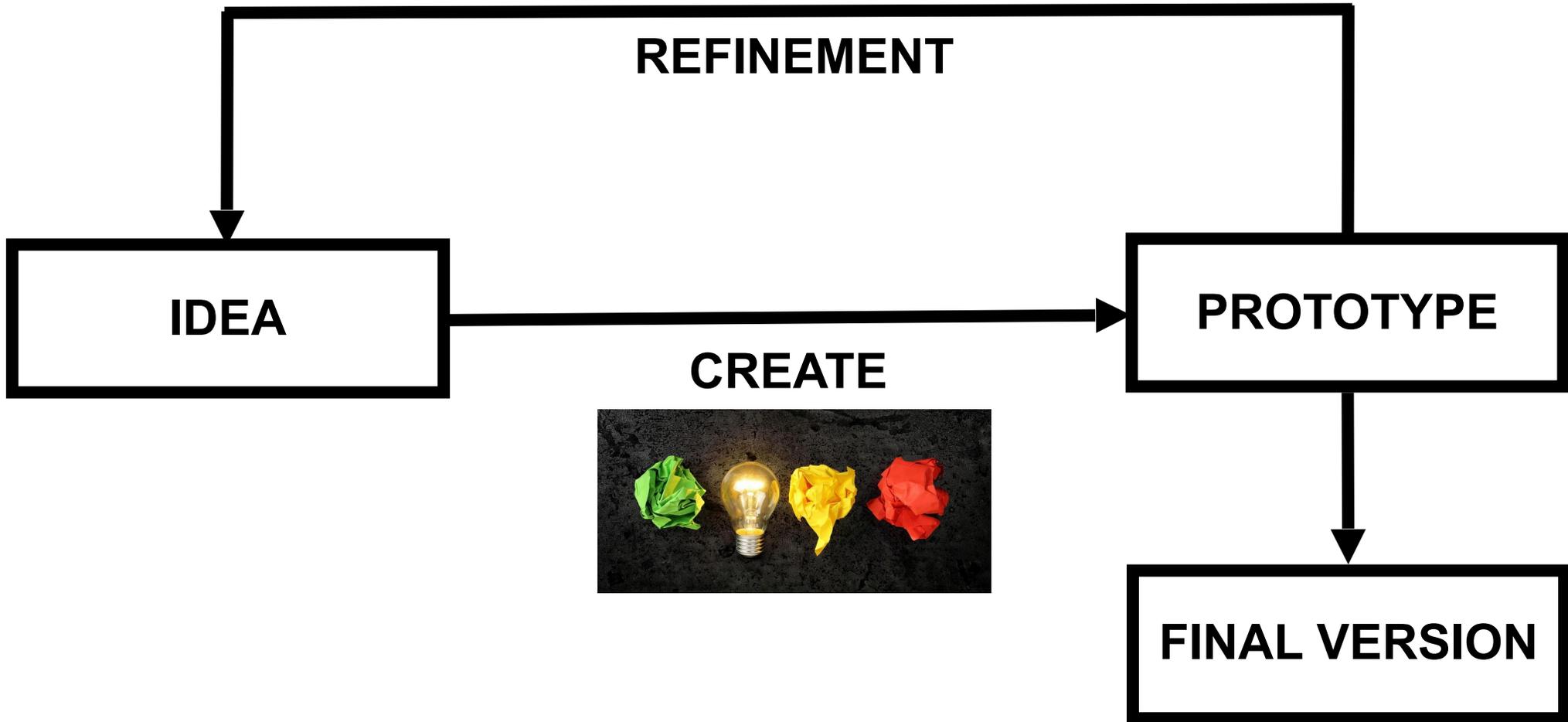


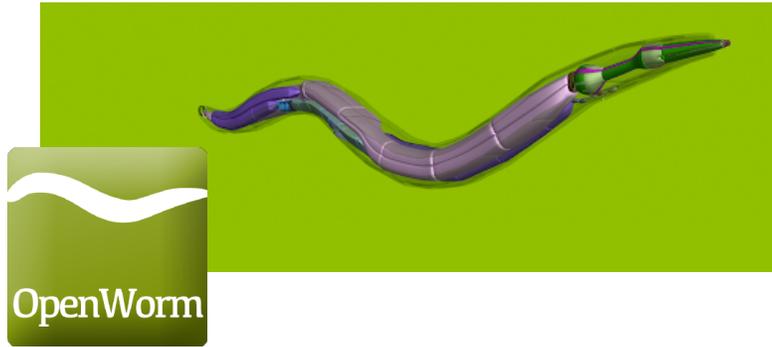
Wellness Daily
Episode 123
by Isaac J. Galvan

Creating a prototype

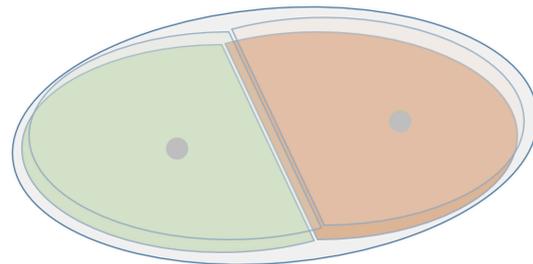
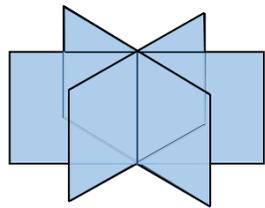
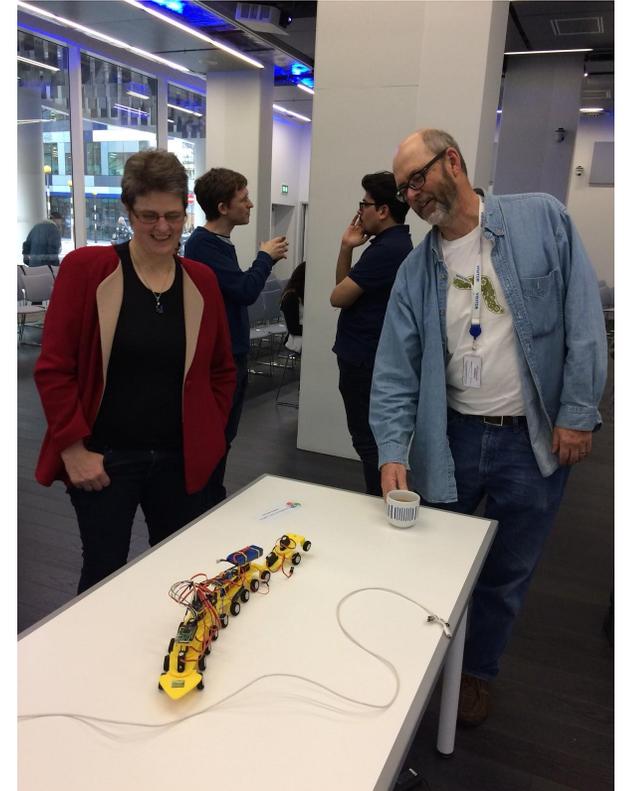


Open-source Rapid Prototyping Example 1



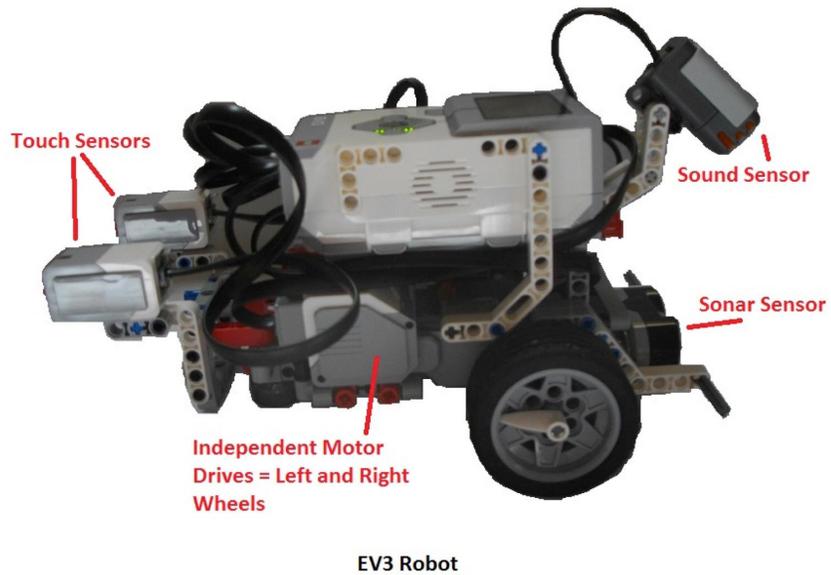


OpenWorm robots



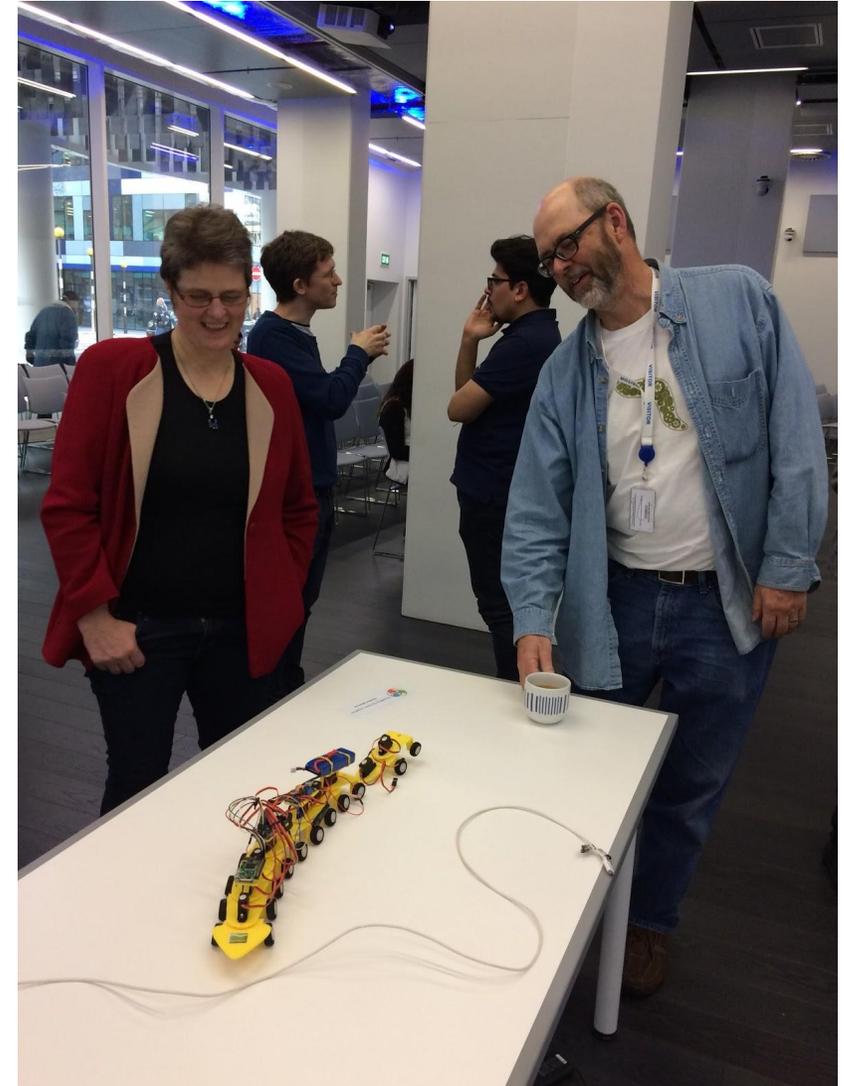
Open-source collaborative papers

OpenWorm robots



Circa 2013

Use a computational model of the connectome to move the robot.



Circa 2018

Why use Github?

master 2 branches 0 tags

portegys Merge pull request #7 from jacopomaroli/improve_portability ✓ 6c20f74 on Aug 1 45 commits

WormESP32	Constrain maximum steps	2 years ago
WormHost	Control servos with segment angles	3 years ago
WormRPi	ESP32 food foraging with ultrasonic distance sensor	2 years ago
WormSim	improve portability	3 months ago
assembly	Include description paper	2 years ago
docs	Include description paper	2 years ago
.gitignore	empty line EOF	3 months ago
README.md	Include description paper	2 years ago

About

C. elegans robots

tom.portegys.com/research.html

Readme

Releases

No releases published

Packages

No packages published

Contributors 5



Languages



C	75.9%	MATLAB	7.1%
C++	4.6%	Makefile	3.2%
Shell	3.0%	Fortran	2.4%
Other	3.8%		

README.md

robots

C. elegans robots.

The goal of this project is twofold:

1. To build a robot that simulates the neuromuscular function of a C. elegans nematode worm.
2. To specify a kit of parts and instructions that will allow a student to also build the robot.

The robot is controlled by a Raspberry Pi/ESP32 processor that contains a recorded simulation of the worm's neuromuscular system (see references). The robot's body is a sequence of segments that mutually exert simulated muscle contractions implemented by servos.

Folders:

1. WormHost: PC code to communicate with the onboard Raspberry Pi.
2. WormRPi: Raspberry Pi onboard code.
3. WormESP32: ESP32 onboard code.
4. WormSim: C. elegans neuromuscular simulator.
5. assembly: parts list, 3D printing .stl shape files, and assembly instructions.
6. docs: robot description.

References: Boyle, Berri and Cohen, "Gait modulation in C. elegans: an integrated neuromechanical model",

Why use Github?

Open parts list

README.md

robots

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openworm / robots

<> Code 5 Issues Pull requests Actions Projects Wiki Security Insights

master 2 branches 0 tags

Go to file Add file Code

portegys Merge pull request #7 from jacopomaroli/improve_portability ✓ 6c20f74 on Aug 1 45 commits

WormESP32	Constrain maximum steps	2 years ago
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C. elegans robots

tom.portegys.com/research.html

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Releases

No releases published

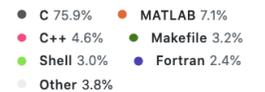
Packages

No packages published

Contributors 5



Languages



Provides an inventory of which languages are most frequently used

#robots ☆

🔖 16 | GitHub Repo at: <https://github.com/openworm/robots>



236

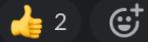


April 17th, 2019 ▾



Tom Portegys 9:45 PM

Sensor working OK, now to test with robot.



April 21st, 2019 ▾



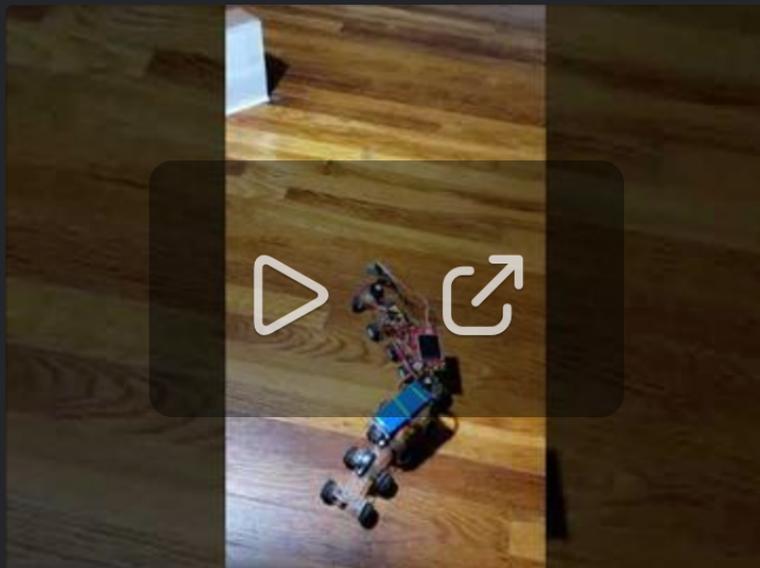
Tom Portegys 11:12 PM

The sonic sensor has an unfortunately wide receptor field, but I did get a couple of successful tests: <https://www.youtube.com/watch?v=BD-n1SASU4I>
<https://www.youtube.com/watch?v=OIZyOVygVxw>



YouTube | Tom Portegys

[C. elegans robot seeks food to its left ▾](#)



YouTube | Tom Portegys

Testing and deployment via Slack

- enables world-wide collaboration and brainstorming.

April 22nd, 2019 ▾



Shane Gingell 11:18 PM

I am thinking the battery you have dips voltage when you run the servos

To get the TOF sensor to work while the servos are running means you have 2 options.



11:21 1. attach a capacitor to the battery, this is what the Quad copter guys do as their motors use crazy high sudden draw of current. something like this <https://oscarliang.com/capacitors-mini-quad/>

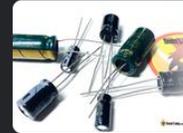


Oscar Liang

[Capacitors For Noise Filtering in Mini Quad - Oscar Liang](#)

Capacitors can make your FPV video signal cleaner, and your mini quad fly better. In this tutorial we will explain what types of low ESR capacitor you should get and why low ESR is important, and where to install the caps in a racing drone.

Jul 27th, 2018



Shane Gingell 11:27 PM

or 2. use a separate little battery for the tof sensor. The TOF sensor runs on 2.8v but it has an on board voltage regulator so it can be powered by higher voltages. U should be able to pwer it very nicely on any tiny little 1S lithuim battery like this <https://www.sparkfun.com/products/13853> you can connect the positive from battery to the TOF sensor then connect a common ground from battery to both TOF sensor and My ESP32 board



sparkfun.com

[Lithium Ion Battery - 110mAh](#)

This is a very small, extremely light weight battery based on Lithium Ion chemistry. This is the highest energy density currently in production. Each cells



April 23rd, 2019 ▾

Iterative testing and conversations in Slack

December 2nd, 2018

Tom Portegys 1:02 AM
Assembled and ready to test.
20181202_005927.jpg



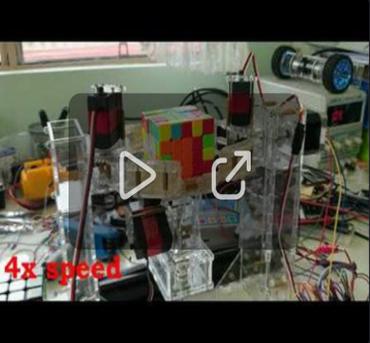
2

Shane Gingell 3:11 PM
Ok I am, now nervous
Does the whole build now seem much more simple??

February 3rd, 2019

Shane Gingell 12:23 AM
I got my robot to a stage that it can solve 5x5x5 cubes although it needs the movements optimized as at the moment it takes over 10mins to solve
https://www.youtube.com/watch?v=9ORa0B_Mrtw&feature=youtu.be

YouTube Out of the BOTS
5x5x5 Rubik's Cube solving robot solves a cube



1

November 23rd, 2018

Shane Gingell 4:03 AM
It will only be cool if I make it all work 😊

November 25th, 2018

Shane Gingell 6:41 PM
20181126_103902.jpg



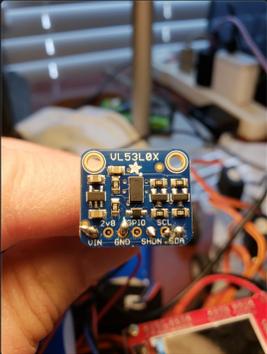
I have used wheels with rubber grips that r wide and flat so to get much better traction with the ground
The new body section is about half an inch thinner and half an inch lower in height

Shane Gingell 10:41 PM
<https://www.youtube.com/watch?v=boiDXGzUigA&feature=youtu.be>
YouTube Out of the BOTS

January 21st, 2019

it is late here tonight but I will hook up mine in the morning and if I can work why yours isn't working.

Tom Portegys 11:23 AM
I have VIN on the board connected to SHDN on the chip. But it should be 3V3 on the board? I also had a problem soldering accidentally globbing solder across SCL and SDA but I think that should be OK now (see pic).
20190121_111016.jpg



Shane Gingell 4:43 PM
So Vin stands for voltage in so Vin on my board is the voltage in before the volatge regulator drops it down to 3.3v for the circuits. The TOF sensor runs on 2.8v because it is designed for power saving for mobile devices like phones. So the sensor has 3.3v Vin then it has a voltage regulator on the board that drops it down to 2.8v (see the black chip to far left in ur pic)

A photograph of a classroom. An instructor, a man in a light-colored button-down shirt and a blue face mask, stands in the foreground on the right, facing a group of students. The students are seated at desks, many wearing face masks. One student in the center is wearing a grey sweatshirt with "ILLINOIS" printed on it. The room has large windows with wooden frames and a whiteboard in the background. The text "The User Story" is overlaid in the center of the image.

The User Story

As an instructor, I want to to share episode with my students so they can listen to them easily and we can discuss them in class.

Illinois Podcasts

CHEM 103 Section A

Contact: igalvan@illinois.edu



Outstanding in the
Field

Episode 42: Something



Rising to the Challenge
Episode 2: Key Choices



Gies College of
Business



All Colleges
Episode 12

All Classes

Chem 103 Section A

AgSci 12 Section 123

Spanish 223

Art History

Illinois Podcasts

CHEM 103 Section A

Contact: igalvan@illinois.edu

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November 13, 2020



Out Standing in a Field
Episode 42: Something



Rising to the Challenge
Episode 2: Key Choices

November 7, 2020



Business Podcast
18: Learning to Fly



All Colleges
Episode 12

Illinois Podcasts

CHEM 103 Section A

Contact: igalvan@illinois.edu

Following

November 13, 2020



Out Standing in a Field
Episode 42: Something



Rising to the Challenge
Episode 2: Key Choices

November 7, 2020



Business Podcast
18: Learning to Fly



All Colleges
Episode 12

My Classes

ADV 460 Innovation in Advertising
Next: 2020-11-13



BADM 540 Frontiers in Technology
Next: 2020-11-7

All Classes

Chem 103 Section A
Next: 2020-11-13

AgSci 12 Section 123
Next: 2020-11-7

Spanish

Creating a prototype



Open-source Rapid Prototyping

Example 2

Ten simple rules for collaboratively writing a multi-authored paper

Marieke A. Frassl  , David P. Hamilton, Blaize A. Denfeld, Elvira de Eyto, Stephanie E. Hampton, Philipp S. Keller, Sapna Sharma, Abigail S. L. Lewis, Gesa A. Weyhenmeyer, Catherine M. O'Reilly, Mary E. Lofton, Núria Catalán

Opportunities and obstacles for deep learning in biology and medicine [update in progress]

Update Underway

A published version of this manuscript from 04 April 2018, termed version 1.0, is available at <https://doi.org/10.1098/rsif.2017.0387>. A new effort is underway to update the manuscript to a version 2.0 that is current as of the first half of 2020. New authors and links to new sections are available in [GitHub Issue #959](#).

This manuscript ([permalink](#)) was automatically generated from [greenelab/deep-review@cfa2a35](#) on August 10, 2020.

▼ Authors

Version 2.0 authors

 Casey S. Greene^{2.1,2.2,[†]  Daniel C. Elton^{2.3},  Alexander J. Titus^{2.4},  Anthony Gitter^{2.5,2.6,[†]  Daniel S. Himmelstein^{2.7},  Brock C. Christensen^{2.4},  Joshua J. Levy^{2.8}, [The Version 1.0 Deep Review Authors](#)}}

 — Author order for version 2.0 is currently randomized [with each new build](#).

[†] — To whom correspondence should be addressed: gitter@biostat.wisc.edu (A.G.) and greenescientist@gmail.com (C.S.G.)

Collaborative documents on Github:

Academic literature reviews.

Description of software and methods.

Using issues to assign tasks and organize related resources

greenelab / deep-review

Watch 128 Star 1.1k Fork 260

Code Issues 418 Pull requests 2 Actions Projects Wiki Security Insights

 Want to contribute to greenelab/deep-review?
If you have a bug or an idea, read the [contributing guidelines](#) before opening an issue.

Filters is:issue is:open Labels 18 Milestones 0 [New issue](#)

418 Open 228 Closed Author Label Projects Milestones Assignee Sort

-  **Add a Systematic Text-Mining Component to the Review?** #1022 opened 2 days ago by swamidass  3
-  **Update for 2020?** #1021 opened on Aug 25 by swamidass  3
-  **Human Protein Atlas (HPA) Cell Type Prediction using Deep Learning and estimating uncertainty** #1017 opened on May 15 by birajaghoshal  2
-  **DeepArk: modeling cis-regulatory codes of model species with deep learning** paper #1016 opened on Apr 28 by evancofer
-  **LISA: Towards Learned DNA Sequence Search** paper #1015 opened on Apr 28 by evancofer  1
-  **Applications in sleep research** #1013 opened on Apr 6 by SystemsResearch  2

Version Control and Rapid Prototyping

Diffs: line-oriented edit distance. Can use this to compare changes in a pull request, previous versions.

The screenshot shows a commit history on the left with the commit 'Update diffs-example.md' on Oct 26, 2020. Below it, a summary states 'Showing 1 changed file with 1 addition and 1 deletion.' The main area displays a diff for 'Tutorials/diffs-example.md'. The diff shows a deletion of the line '- The quick brown fox jumps over the lazy moon!' (highlighted in red) and an addition of the line '+ The quick brown fox is crazy like its conspecifics, and jumps over the moon!' (highlighted in green). Two arrows point from the text 'Deletions' and 'Additions' to the respective lines in the diff.

Commits on Oct 26, 2020

Update diffs-example.md

Verified 358e05b

Unified Split

Showing 1 changed file with 1 addition and 1 deletion.

2 Tutorials/diffs-example.md

```
@@ -1 +1 @@
- The quick brown fox jumps over the lazy moon!
+ The quick brown fox is crazy like its conspecifics, and jumps over the moon!
```

Deletions

Additions

Version Control and Rapid Prototyping

History for [GSoC-Braitenberg-Vehicles](#) / [Manuscript](#) / manuscript-doc.md

Commits on Feb 28, 2020

Update manuscript-doc.md Orthogonal-Research-Lab committed on Feb 28	Verified		e52a4ec	
Update manuscript-doc.md Orthogonal-Research-Lab committed on Feb 28	Verified		7b26099	

Commits on Feb 24, 2020

Update manuscript-doc.md Orthogonal-Research-Lab committed on Feb 24	Verified		bed10a2	
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Commits on Feb 23, 2020

Update manuscript-doc.md Orthogonal-Research-Lab committed on Feb 23	Verified		9b442d1	
Update manuscript-doc.md Orthogonal-Research-Lab committed on Feb 23	Verified		b0e8f2b	
Update manuscript-doc.md Orthogonal-Research-Lab committed on Feb 23	Verified		1cd6532	
Update manuscript-doc.md Orthogonal-Research-Lab committed on Feb 23	Verified		89d7e36	
Update manuscript-doc.md Orthogonal-Research-Lab committed on Feb 23	Verified		73e5db0	
Update manuscript-doc.md Orthogonal-Research-Lab committed on Feb 23	Verified		4587009	

Commits on Oct 26, 2019

Commit history:
View a history of all commits to a document, recover/consult versions as needed.

Open Papers with formatting (Markdown with HTML, LaTeX elements)

339 lines (198 sloc) | 54.8 KB

Raw Blame

Please install [MathJax Plugin for Github](#) or [Math Anywhere](#) Chrome plug-ins to view equations

Braitenberg Vehicles as Developmental Neurosimulation

Stefan Dvoretzki^{1,2}, Ziyi Gong^{2,3}, Ankit Gupta^{2,4}, Jesse Parent², Bradly Alicea^{2, 5}

¹ Technical University of Munich, ² Orthogonal Research and Education Laboratory, ³ University of Pittsburgh, ⁴ IIT Kharagpur, ⁵ OpenWorm Foundation

Abstract

The connection between brain and behavior is a longstanding issue in the areas of behavioral science, artificial intelligence, and neurobiology. Particularly in artificial intelligence research, behavior is generated by a black box approximating the brain. As is standard among models of artificial and biological neural networks, an analogue of the fully mature brain is presented as a blank slate. This model

priori associations, yet this does not consider the realities of biological development and to model the development of an artificial organism that exhibits complex behaviors. We will Braitenberg Vehicles (BVs) to model the development of an artificial nervous system. The resulting behaviors that range from stimulus responses to group behavior that resembles collective motion. Next, artificial brain networks. Then we will focus on broader themes such as embodied cognition, cognitive will then be exemplified by three software instantiations that demonstrate how a BV-genetic ebbian learning model, and multi-agent approaches can be used to approach BV development. We spatial cognition (vehicle-genetic algorithm hybrid model), hinges connecting behavioral and neural model), and cumulative classification (multi-agent approaches). In conclusion, we will revisit how they might guide future development.

27 lines (22 sloc) | 2.02 KB

Raw Blame

$$O_{x,y,i} = \sum_k I_{o,i}^{(k)} \exp\left(\frac{d_{x,y}^{(k)}}{cd_{\max}}\right) \quad G_{x,y,i} = \sum_k I_{g,i}^{(k)} \Theta(d' - d_{x,y}^{(k)}) \quad (2)$$

where $O_{x,y,i}$ is the i th olfactory feature sensible at position (x, y) , and $I_{o,i}^{(k)}$ is the i th feature of the odor omitted by stimulus source k ; similarly, G and I_g are for gustatory features. $d_{x,y}^{(k)}$ is the Euclidean distance from (x, y) to source k , while d_{\max} is the maximum distance in the space, d' is the gustatory sensible threshold, and c is an arbitrary scalar. Θ is the standard Heaviside function.

Li-Hopfield Network

$$\frac{dx}{dt} = I + Lf_x(x) - Mf_y(y) - a_x x \quad \frac{dy}{dt} = I_c + Gf_x(x) - a_y y \quad (3)$$

where x and y are the internal states of mitral cells and granule cells. M , G , and L are the weight matrices from granule to mitral, mitral to granule, and mitral to mitral, respectively. f are activation functions, while Γ is a function setting the lower triangular entries to zeros. I is the input and I_c is the constant ("center") input. a is the time constant.

Bidirectional Associate Memory Using Generalized Hebbian Algorithm with Depression

$$\frac{dW}{dt} = \eta_t I_o' I_g^r - W \Gamma(I_o' I_g^r) - D \quad D_{ij} = \frac{\phi}{I_{o,j}' W_{ij}^2 + 1} \lim_{t \rightarrow \infty} \eta_t = 0 \quad \lim_{t \rightarrow \infty} \sum_t \eta_t = \infty \quad (4)$$

where W is the association between I_o' , the processed olfactory input, and I_g^r , punished by the depression matrix D with a depression rate ϕ . $D_{ij} \mapsto 0$ if the denominator of D_{ij} is zero.

Simple Judgement Unit

$$p = \sum_i J_i(I_{g,i}') \quad (5)$$

Archiving papers with formatting

devoworm / ALIFE-2020

Watch 0 Star 1 Fork 1

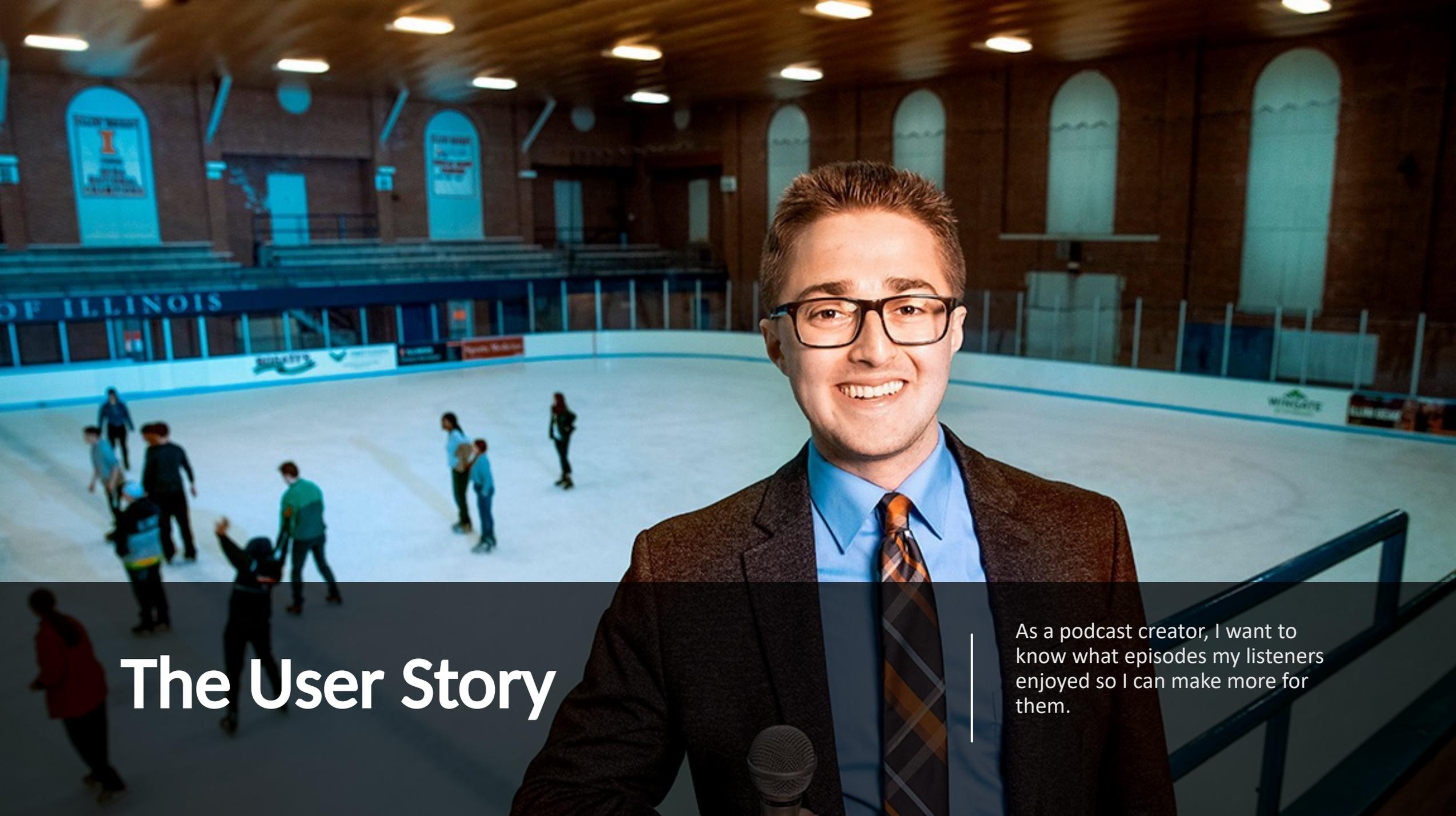
Code Issues Pull requests Actions Projects Wiki Security Insights

master ALIFE-2020 / DevoNN workshop / Meta-brain Models paper /

Go to file Add file

 devoworm	Add files via upload	3406215	on Jul 24	 History
..				
 Abstract.tex	Create Abstract.tex			3 months ago
 Figure 1.png	Add files via upload			3 months ago
 Figure 2.png	Add files via upload			3 months ago
 Figure 3.png	Add files via upload			3 months ago
 alifeconf.sty	Create alifeconf.sty			3 months ago
 bibliography.bib	Create bibliography.bib			3 months ago

BOTTOM LINE: Building a paper collaboratively in Github encourages you to adopt a rapid prototyping methodology!



The User Story

As a podcast creator, I want to know what episodes my listeners enjoyed so I can make more for them.

Good Growing



Ep. 43 Talking Houseplants
with Candice Hart

135

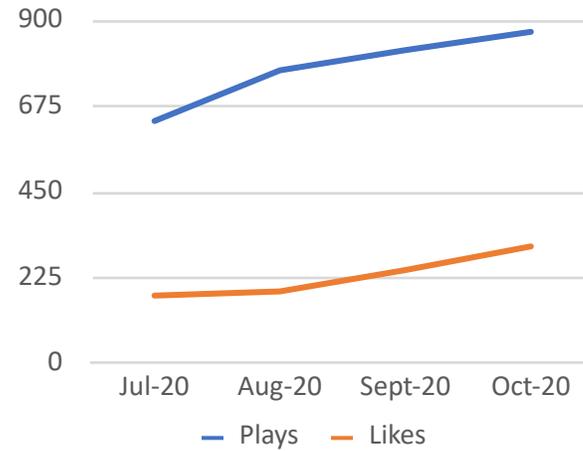
Ep. 42 Talking Spooky Plants
with the Hosts

308 likes
770 plays

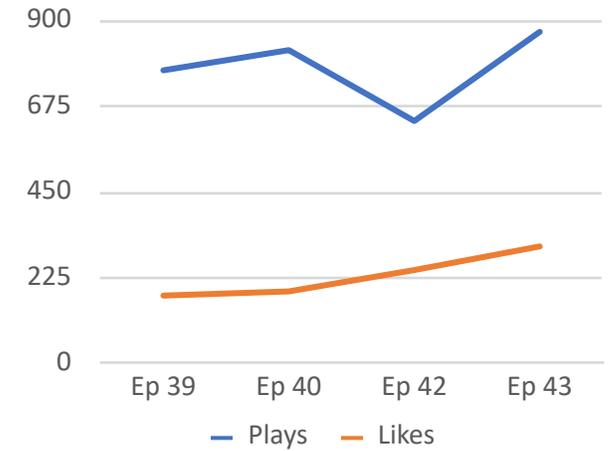
Ep.40 Pumpkins with Nathan
Johanning

Ep. 39 Soils with Duance
Friend

Good Growing



Good Growing



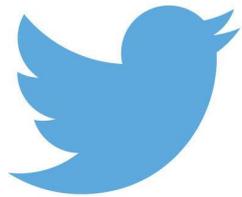
Thank you

- [WWDC 2017: 60 Second Prototyping](#)
 - <https://github.com/rokwire/rokwire-community>
 - <http://publish.illinois.edu/bradly-alicea/>
 - <https://publicaffairs.illinois.edu/services/image-database/>
- Isaac J. Galvan – igalvan@illinois.edu
 - Bradly Alicea – balicea@illinois.edu

Website: <http://rokwirecommunity.web.illinois.edu>

Github: <http://www.github.com/rokwire>

Community Calls and Public Events coming soon!



<https://twitter.com/RokwireC>

R COMMUNITY



<https://www.linkedin.com/showcase/rokwire-/>

Welcome to the Rokwire Community!

Questions? Contact balicea@illinois.edu