PROJECT SIDEWALK

CROWD + AI TOOLS TO MAP & ASSESS SIDEWALK ACCESSIBILITY

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SciStarter Live
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SIDEWALKS ARE CRITICAL PUBLIC INFRASTRUCTURE
INDEPENDENCE, QUALITY OF LIFE, PHYSICAL ACTIVITY

Thapar et al., 2004; Nuernberger, 2008
PHYSICAL OBSTACLES
This designed inaccessibility contributes to and further reinforces systemic inequalities in economic opportunity and access to basic health and educational services for people with disabilities.

- UN NEW URBAN AGENDA 2020
See Section 1.1.3
"INJUSTICE ANYWHERE IS A THREAT TO JUSTICE EVERYWHERE."

Martin Luther King, Jr.
L.A. agrees to spend $1.3 billion to fix sidewalks in ADA case

Los Angeles is pledging to spend more than $1.3 billion over the next three decades to fix its massive backlog of broken sidewalks and make other improvements to help those with disabilities navigate the city as part of a tentative deal being described as a landmark legal settlement.

The proposed agreement would resolve a lawsuit filed by attorneys for the disabled, who argued that crumbling, impassable sidewalks and other barriers prevented people in wheelchairs or others with mobility impairments from accessing public pathways in violation of the Americans With Disabilities Act.

The final terms must still be approved by a federal judge, but attorneys described it as a “landmark settlement that should be a model for many other municipalities in our country.”

The settlement includes $800 million to repair sidewalks, $300 million for other improvements, and $100 million to create a trust fund to finance future improvements.

The agreement calls for the city to create a detailed plan for addressing the backlog, which is estimated to include more than 100,000 broken or missing sidewalks.

The settlement also includes provisions for the city to improve accessibility for people with disabilities in other areas, such as bus stops and public buildings.

The agreement is expected to be finalized in the coming weeks, with a hearing scheduled for later this month.

BY EMILY ALPERT REYES | STAFF WRITER
APRIL 1, 2015 3:34 PM PT
The problem is not just a lack of accessible sidewalks. A lack of data.
The National Council on Disability notes that there is **no comprehensive information** on “the degree to which sidewalks are accessible” in cities.
STUDY OF OPEN DATA ON SIDEWALKS

178 US CITIES

- 54% OPEN STREET DATA
- 20% SIDEWALKS
- 10% CURB RAMPS
- <5% BASIC ACCESSIBILITY INFO

BACKGROUND

STUDY OF ADA TRANSITION PLANS

401 LOCAL GOVERNMENTS

13% w/ADA transition plans

1.7% Met minimum requirements

We are pursuing a **two-fold solution**
To develop new data collection methods that combine crowdsourcing + AI
To create **new urban accessibility analytics** not previously possible
Labeling missions

Validation missions

ONLINE MAP IMAGERY

REMOTE CROWDSOURCING INTERFACES

MACHINE LEARNING

HUMAN LABELS
New Urban Analytics

Interactive visualization tools

Improved urban planning

Improved government transparency

MACHINE LEARNING

OUTCOMES
Figure 3: In this paper, we present Tohme, a scalable solution for semi-automatically finding curb ramps in Google Street View (GSV) panoramic imagery using computer vision, machine learning, and crowdsourcing. The images above show an actual result from our evaluation.

ABSTRACT
Building on recent prior work that combines Google Street View (GSV) and crowdsourcing to remotely collect information about physical world accessibility, we present the first "smart" system, Tohme, that combines machine learning, computer vision (CV), and custom crowd interfaces to find curb ramps remotely in GSV scenes. Tohme consists of two workflows, a human labeling pipeline and a CV pipeline with human verification, which are scheduled dynamically based on predicted performance. Using 1,868 GSV scenes (street intersections) from four North American cities and data from 403 crowd workers, we show that Tohme performs similarly in detecting curb ramps compared to a manual labeling approach alone (F-measure: 34% vs. 80% baseline), but at a 13% reduction in time cost. Our work contributes the first CV-based curb ramp detection system, a custom machine-learning-based workflow controller, a validation of GSV as a viable curb ramp data source, and a detailed examination of why curb ramp detection is a hard problem along with steps forward.

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Tohme: Detecting Curb Ramps in Google Street View Using Crowdsourcing, Computer Vision, and Machine Learning
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ABSTRACT
Recent work has applied machine learning methods to automatically find infrastructure in online map imagery (e.g., satellite photos, streetscape panoramas). While promising, these methods have been limited by two inter-related issues: small training sets and the choice of machine learning model. In this paper, we also used the recently released Project Aerial Imagery (39,000+ V1.0 image-based sidewalk accessibility labels, we present the first examination of deep kernels to automatically classify sidewalks in Google Street View (GSV) panoramas. Specifically, we investigate two application areas: automatically validating photos and labeling sidewalk accessibility issues. For both tasks, we introduce and use a residual neural network (ResNet) modelled to support both image and non-image (context) features (e.g., geography). We present an analysis of the performance, the effect of our non-image features and training size, and objectivity generalizability. Our results significantly improve on prior automated methods and, in some cases, meet or exceed human labeling performance.

Author Keywords
Crowdsourcing accessibility, computer vision, Google Street View, Amazon Mechanical Turk

ACM Classification Keywords
I.3.7. Artificial Intelligence: Vision and Scene Understanding
I.2.10. Artificial Intelligence: Learning

INTRODUCTION
Sidewalks should benefit all of us. They provide a safe, environmentally-friendly conduit for moving about a city. For people with disabilities, sidewalks can have a significant impact on independence [45], quality of life [28], and physical activity [17]. While mapping tools like Google and Apple Maps have begun to offer pedestrian-focused features, they do not incorporate sidewalk routes or information on sidewalk accessibility. These limitations mean that people with disabilities are at a disadvantage and disproportionately affects people with disabilities. A key challenge is data. Where does it come from? How is it collected?

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Deep Learning for Automatically Detecting Sidewalk Accessibility Problems Using Streetscape Imagery
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ABSTRACT
Deep learning has been applied to many computer vision and machine learning tasks in recent years, but it is not yet typically open (i.e., published online), and is not intended for end-user tools [23, 30]. To expand who can collect sidewalk data and improve the accessibility of new tools, researchers have introduced smartphone-based tools [15, 46, 52] as well as instrumented wheelchair users [35, 39, 51, 52]. However, these tools have been limited by low adoption, small geographic coverage, and high user burden (e.g., requiring users to take photos, upload an app, take a picture, annotate it, and upload it) [20, 23].

To partially address these scalability issues, researchers have begun developing automated methods for sidewalk assessment using machine learning and online imagery (e.g., satellite photos [10, 8], panoramic streetscape imagery [31, 32, 90]). While still early, these complementary approaches promise to dramatically decrease manual labor and cost. However, they have been limited by two inter-related issues: small training sets and the choice in machine learning model—both of which negatively impact performance. In this paper, we attempt to address both of these issues.

We present the first examination of deep learning methods to automatically assess sidewalk accessibility in terms of curb ramps, missing curb ramps, surface problems, and sidewalk obstacles from widely available streetscape imagery. Our work is enabled by the recently released Project Sidewalk open dataset, which contains a corpus of 300,000+ image-based sidewalk accessibility labels collected via remote crowdsourcing in Google Street View (GSV) ([15]) (Figure 1). Specifically, we investigate two application tasks using GSV panoramas: automatically validating pedestrian-focused features and automatically labelling sidewalk accessibility issues.

Acknowledgments
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1 In some examples, the South Dakota Department of Transportation completed their first ever sidewalk assessment in 2016, which took 116 man-hours to complete (1)
Virtually explore city streets
REMOTE CROWDSOURCING

LABELING MEXICO CITY FROM GERMANY!
PROJECT SIDEWALK

TWO DATA COLLECTION MISSIONS

1. FIND, LABEL, & ASSESS SIDEWALKS

2. VALIDATING & CORRECTING LABELS
In this Street View image, we have drawn an arrow to a curb ramp. Let's label it. Click the flashing "Curb Ramp" button above.

Explore 250 ft in Central Oradell

Your mission is to explore 250 ft in Central Oradell and find all the accessibility features that affect mobility impaired travelers!
Explore the streets and find all the accessibility attributes.

CLICK SURFACE PROBLEM
Explore the streets and find all the accessibility attributes.

Current Neighborhood:
Central Oradell, Oradell
0.0 miles
34 labels

Current Mission:
Explore 250 ft of this neighborhood
0% complete

- 4 curb ramps
- 1 surface problem
- 0 missing curb ramp
- 1 no sidewalk
- 0 obstacle
- 4 others

Follow the red line.

Tags:
- bumpy
- cracks
- grass
- narrow
- brick
- construction
- uneven/slanted
- very broken
- height difference
- rail/tram track
- sand/gravel

Temporary (e.g., construction)
OK
Explore the streets and find all the accessibility attributes.
EXAMPLE OBSTACLE TAGS

- Tree
- Fire hydrant
- Parked car
- Pole
- Garbage/recycling can
- Stairs
- Vegetation
- Height difference

- Description (optional)
- Add Tags: pole, tree, vegetation, trash/recycling can, parked car, sign, garage entrance, stairs, street vendor, height difference, narrow, litter/garbage, parked scooter/motorcycle
- Temporary (e.g., construction)
PROJECT SIDEWALK

TWO DATA COLLECTION MISSIONS

1. FIND, LABEL, & ASSESS SIDEWALKS

2. VALIDATING & CORRECTING LABELS
Is this a Missing Curb Ramp?
Is this a **Surface Problem?**

![Image of a tree trunk on a sidewalk with pebbles and a crack]

- **Agree**
- **Disagree**
- **Not sure**

Add comment here...
Is this an Obstacle?

Pole is not an obstacle here

Agree

Disagree

Not sure

Add comment here...
Sidewalks often have buffer zones.
ONLY MARK BARRIERS IN THE PEDESTRIAN PATH
We also try to make Project Sidewalk fun and educational
Your missions: 140
Distance: 2.03 mi
Labels: 568
Validations: 1249
Accuracy: 90.7%

Achievements:

Missions:
Congratulations, you've earned all mission badges!

Distance:
Thanks for helping! 2.97 more miles until your next achievement.

Labels:
Great job! 432 more labels until your next achievement.

Validations:
Amazing work! 3751 more validations until your next achievement.
# Overall Leaderboard

Leaders are calculated based on their labels, distance, and accuracy.

<table>
<thead>
<tr>
<th>#</th>
<th>Username</th>
<th>Labels</th>
<th>Missions</th>
<th>Distance</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>mariana.velasco</td>
<td>2894</td>
<td>150</td>
<td>9.6 miles</td>
<td>85.3%</td>
</tr>
<tr>
<td>2</td>
<td>maria</td>
<td>1918</td>
<td>51</td>
<td>9.0 miles</td>
<td>89.1%</td>
</tr>
<tr>
<td>3</td>
<td>abarragan99</td>
<td>1895</td>
<td>81</td>
<td>2.7 miles</td>
<td>86.5%</td>
</tr>
<tr>
<td>4</td>
<td>marian.trevino</td>
<td>1543</td>
<td>66</td>
<td>9.4 miles</td>
<td>82.2%</td>
</tr>
<tr>
<td>5</td>
<td>dordaz</td>
<td>1483</td>
<td>46</td>
<td>3.5 miles</td>
<td>84.2%</td>
</tr>
<tr>
<td>6</td>
<td>Gerardo R</td>
<td>1274</td>
<td>86</td>
<td>5.4 miles</td>
<td>87.6%</td>
</tr>
<tr>
<td>7</td>
<td>mariagarza</td>
<td>1205</td>
<td>62</td>
<td>9.4 miles</td>
<td>87.2%</td>
</tr>
<tr>
<td>8</td>
<td>ana.alvarezc</td>
<td>1053</td>
<td>63</td>
<td>9.8 miles</td>
<td>84.8%</td>
</tr>
<tr>
<td>9</td>
<td>Gari01234</td>
<td>848</td>
<td>62</td>
<td>4.6 miles</td>
<td>89.1%</td>
</tr>
<tr>
<td>10</td>
<td>Luis Gonzalez</td>
<td>812</td>
<td>59</td>
<td>9.7 miles</td>
<td>94.1%</td>
</tr>
</tbody>
</table>

Want to make it into the Top 10? [Start exploring!](start-exploring)
PILOT DEPLOYMENT IN 2017

Audit the streets and find all the accessibility attributes.

Current Neighborhood: Monument/City D.C.

Current Mission: Audit 100% of this neighborhood.

Washington DC
STREET ACCESSIBILITY SCORE VISUALIZATION
Problem Count
Low
High
Anacostia
Lower socio-economic area
92% Black, 5% Non-Hispanic White, 3% Other
Georgetown
Highly affluent, historic area
82% White, 8.7% Asian, 6.2% Black,

Anacostia
Lower socio-economic area
92% Black, 5% Non-Hispanic White, 3% Other
This is the potential of **data-driven urban accessibility analytics** using Project Sidewalk data.
PROJECT SIDEWALK

ALL OUR CODE + DATA IS 100% OPEN SOURCE

https://github.com/ProjectSidewalk

http://projectsidewalk.io/api
A city is only as accessible as its sidewalks. This map shows DC’s are often blocked.

When Washingtonians like myself look for new apartments, we pay close attention to the walk score of a neighborhood. Any score upwards of 90 on a hundred point scale marks an area as a “walker’s paradise,” meaning major needs such as grocery stores and transit are within walking distance. However, what is not factored into the walkability score is the actual condition of the sidewalks.
Seattle, WA
Newberg, OR
Chicago, IL
Columbus, OH
Pittsburgh, PA
Washington DC
San Pedro Garza García, MX
Mexico City, MX
La Piedad, MX
Newberg, NJ

TEN CITIES IN NORTH AMERICA

PROJECT SIDEWALK
Your efforts are making a difference. Transforming policy. Informing urban design. Creating better, more equitable transit networks.
Newberg, OR
http://newberg.projectsidewalk.org
NEWBERG, OR
http://newberg.projectsidewalk.org

235 USERS
17,400 LABELS
12,500 VALIDATIONS
Congratulations and THANK YOU to the citizens of Newberg for putting in the work to map 100% of Newberg through Project Sidewalk. That's over 107 miles covered with 264 local users who contributed to the data.

This information will be used to identify areas in Newberg that need sidewalks, need sidewalk repairs, and need to be updated to become more accessible. Through your efforts, Newberg can become a safer, more accessible community.

Looking to help? Verifications are still needed for the collected data. Click the link below to learn more.
Surface Problems
1,542 labels

Missing Sidewalks
2,456 labels
<table>
<thead>
<tr>
<th>Surface Problem Tags</th>
<th>Count</th>
<th>% of Surface Tags</th>
<th>Avg Severity (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>height difference</td>
<td>1455</td>
<td>29.0%</td>
<td>1.96 (0.99)</td>
</tr>
<tr>
<td>cracks</td>
<td>1256</td>
<td>25.0%</td>
<td>1.71 (0.79)</td>
</tr>
<tr>
<td>uneven/slanted</td>
<td>1031</td>
<td>21.0%</td>
<td>2.34 (1.02)</td>
</tr>
<tr>
<td>grass</td>
<td>547</td>
<td>11.0%</td>
<td>1.46 (0.63)</td>
</tr>
<tr>
<td>very broken</td>
<td>235</td>
<td>5.0%</td>
<td>2.44 (1.04)</td>
</tr>
<tr>
<td>bumpy</td>
<td>177</td>
<td>4.0%</td>
<td>2.25 (0.92)</td>
</tr>
<tr>
<td>n/a</td>
<td>90</td>
<td>2.0%</td>
<td>2.00 (1.02)</td>
</tr>
<tr>
<td>narrow sidewalk</td>
<td>88</td>
<td>2.0%</td>
<td>2.59 (0.93)</td>
</tr>
<tr>
<td>brick/cobblestone</td>
<td>74</td>
<td>1.0%</td>
<td>1.95 (0.72)</td>
</tr>
<tr>
<td>sand/gravel</td>
<td>47</td>
<td>1.0%</td>
<td>2.26 (0.94)</td>
</tr>
<tr>
<td>construction</td>
<td>2</td>
<td>0.0%</td>
<td>4.00 (n/a)</td>
</tr>
<tr>
<td>street has no sidewalks</td>
<td>1</td>
<td>0.0%</td>
<td>3.00 (n/a)</td>
</tr>
</tbody>
</table>
HIGH SEVERITY (≥ 4) SURFACE PROBLEMS
Creemos un camino para todas las personas

Cómo puedes ayudar

Explora virtualmente las calles de la ciudad para mejorar su accesibilidad.
Project Sidewalk provides us with data that is essential to improving San Pedro’s urban accessibility. With Project Sidewalk, we know the main problems to be solved, how many problems there are, and their location… The results will be used to inform a new Pedestrian Master Plan for our municipality.
SAN PEDRO, MEXICO

http://spgg.projectsidewalk.org

1400 USERS
106,500 LABELS
41,000 VALIDATIONS
CURB RAMPS
SEVERITY RATING 5
http://sidewalkgallery.io/

Narrow + obstacle
Not enough landing space
Points into traffic
Narrow
No friction/tactile strip
Not level with street
Steep + obstacle
Steep
Poor design
EvaluANDO: del activismo peatonal a la colaboración comunitaria para el registro de obstáculos en las banquetas

Reseña por
Claudia de Geynza y Ana Rodríguez

Ubicación
San Pedro Gómez, México

Palabras clave
activismo peatonal, movilidad sostenible, infraventa peatonal, participación ciudadana

La vivencia de moverse peatonal no podría ser más privilegiada. En una experiencia de vida, se perciben todos los desafíos que enfrentan las personas con movilidades diversificadas en el espacio público. Aún más, la actualidad y el contexto de pandemia hacen que sean incluso más visibles las dificultades que presentan las personas con movilidades diversificadas. En este sentido, EvaluANDO se propone como un proyecto de colaboración comunitaria que busca involucrar a la comunidad en el registro y el registro de obstáculos en el espacio público, promoviendo una mayor accesibilidad y movilidad sostenible.

El caso de EvaluANDO específicamente se enmarca en el contexto de la pandemia, donde la movilidad peatonal se ha visto aún más complicada. En el proyecto, se busca involucrar a la comunidad en el registro de obstáculos, apoyadas en la tecnología y el diseño de experiencias de usuario. El proyecto se ha implementado en el municipio de San Pedro Gómez, en la Ciudad de México, donde se han registrado diversos obstáculos que dificultan el desplazamiento peatonal.

En el proceso de diseño y creación de la aplicación móvil, se han involucrado a las personas con movilidades diversificadas, asegurando su participación activa y equidad. La aplicación móvil es diseñada para ser accesible y fácil de usar, con una interfaz intuitiva que permite a las personas registrar sus experiencias de manera rápida y sencilla. La aplicación móvil también cuenta con una característica que permite compartir los registros con otros usuarios, promoviendo así una mayor colaboración y participación.

Además, el proyecto promueve la importancia de la educación en el tema de la movilidad sostenible y accesible. Se educan a la comunidad en el tema de la movilidad peatonal y la importancia de su participación activa en la mejora del espacio público.

En conclusión, EvaluANDO es un ejemplo de cómo la colaboración comunitaria y la tecnología pueden ser utilizadas para mejorar la movilidad peatonal y promover la accesibilidad. El proyecto ha demostrado la importancia de involucrar a la comunidad en el diseño y desarrollo de soluciones para mejorar el espacio público, garantizando la igualdad y la sostenibilidad en la movilidad peatonal.
Let's create a path for everyone

Start Exploring Chicago

We are also in: Columbus, OH  La Placita, MX  Amsterdam, NL  Pittsburgh, PA
Sign up

Username

Email address

Password

Confirm password

Are planning to request that your work through Project Sidewalk be counted for community/volunteer service hours?
- Yes
- No

- You agree to our Terms of Use and Privacy Policy

Sign up

Have an account? Sign in

USE THE SAME EMAIL AS ON SCISTARTER
SELECT A CITY!

Let's create a path for everyone

Start Exploring Chicago

We are also in: Columbus, OH, La Piedad, MX, Amsterdam, NL, Pittsburgh, PA
Let's create a path for everyone

Click Start Exploring

Start Exploring Chicago

We are also in: Columbus, OH  La Piedad, MX  Amsterdam, NL  Pittsburgh, PA
Project Sidewalk
@projsidewalk

Our mission: map and assess the world’s sidewalks using remote crowdsourcing, artificial intelligence, and online satellite & streetscape imagery

Seattle, WA  projectsidewalk.org  Joined June 2016

791 Following  925 Followers

In collaboration with @el_colmich & @LigaPeatonal, we are now “live” in La Piedad, Mexico! Join our effort to map & assess sidewalk conditions in Mexican cities to improve safety, accessibility, and quality of life: la-piedad.projectsidewalk.org.
JOIN PROJECT SIDEWALK SLACK

THANK YOU!
Jon E. Froehlich | jonf@cs.uw.edu