The Case for Crowdsourced Bad Driver Reporting

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with massive help from the CS590 Bad Driver Reporting Team

Introduction

It’s difficult to overstate the impact of bad driving on society. In dollars, costs are measured in trillions per year, but that cost is minor compared to the real cost of lives lost and injuries suffered. With over 5 million police-reported traffic accidents a year and another estimated 10 million accidents that go unreported, the numbers are staggering. And those numbers represent a very small fraction of bad driving incidents that are happening on a continuous basis.

There simply aren’t enough law enforcement “eyes on the road” to deter bad driving, however, the problem is amenable to a crowdsourced approach – bad driver data can be gathered by mobile apps similar to how Waze gathers traffic data, and this data can be collected in a video database that can be accessed by insurance companies when issuing and renewing policies. This article details an approach to the problem that we’ve prototyped at the USC Center for Software and Systems Engineering.

Bad driving – how bad is the problem?

Every day in cities around the world, traffic maps break out in a rash of accidents that show up as little red dots on Google Maps.

Figure 1 - Screenshot of actual traffic map around the USC campus at 3PM on a Friday afternoon
But this rash of accidents involves death, injuries, and property damage. Here are some numbers from a 2014 study called Cost of Auto Crashes and Statistics.

- In 2013 there were 5,687,000 police-reported motor vehicle traffic crashes, 32,719 people died in motor vehicle crashes.

- The National Highway Traffic Safety Administration estimates about 10 million or more crashes go unreported each year.

- A motor vehicle death occurred on average every 16 minutes in 2013.

- A motor vehicle injury occurred on average every 14 seconds in 2013.

- U.S. motor vehicle crashes in 2010 cost almost $1 trillion in loss of productivity and loss of life.

As staggering as these numbers are, things are getting worse.

Cost of Auto Crashes & Statistics

The highest price we pay for car crashes is in the loss of human lives, however society also bears the brunt of the many costs associated with motor vehicle accidents. According to the National Highway Traffic Safety Administration (NHTSA), U.S. motor vehicle crashes in 2010 cost almost $1 trillion in loss of productivity and loss of life. The study was released in May 2014. The auto industry's steady improvements in vehicle safety over the last several decades — despite a flurry of safety recalls — had driven down the number of roadway deaths to an all-time low of 32,875 in 2014.

NHTSA reports the number of people killed on the road in the U.S. soared 7.2% to 35,092 in 2015, marking the deadliest year on the road since 2006. Though the increase was widely expected after NHTSA last month revealed a preliminary estimate of a 7.7% increase, the official figure solidifies 2015's dubious distinction as the first year-over-year increase since 2012. In addition, roadway deaths of pedestrians and cyclists hit a two-decade high in 2015.

Figure 2 - Traffic fatalities in 2015 increased 7.2% to 35,092 – almost 1000 deaths every day

Compare these numbers to wars, disease, terrorism, whatever you choose…they are horrifically bad. And yet we all go about our daily lives, driving on the freeway, looking right past this problem as if it’s not even there.

Figure 3 - Bad driving, like alcoholism, is an elephant in the room that nobody talks about
The study above lists alcohol, speeding, red-light running, fatigue, distracted driving, and cellphone use as leading causes of accidents. Cellphone usage in particular leads to many innovative ways to drive badly, as shown below in Figure 4. Additionally, the current trend towards legalization of marijuana probably won’t help the problem.

![Image](https://example.com/image.png)

Figure 4 – Should this bad driver pay more for insurance?

To recap, bad drivers are everywhere and they are an enormous problem to society. Regulatory approaches don’t seem to be working, in large part because there are not enough “eyes on the road”. These factors point to an economic solution (price of obtaining an insurance policy) and a crowdsourced data collection approach.

Insurance companies would happily stop issuing (or raise prices on) policies to bad drivers if they had a good way to identify the risk level associated with a given insurance policy, but how can we gather the data? We believe it’s possible to use crowdsourcing to assemble a video database that provides objective evidence that can be used by insurance companies when issuing and renewing policies that puts a cost on bad driving.

We’ve taken some steps toward developing a solution at USC, in a Directed Research called CS590, where I put 15 Computer Science Masters students to work on the problem.

**Crowdsourced Bad Driver Reporting System – what and why?**

I got this idea for this project while I was working on a consulting assignment that required me to commute from Santa Monica to the Los Angeles Airport (LAX) area, putting me on some of the busiest freeways you’ll find anywhere. In particular the transition from the Santa Monica freeway (Interstate 10) onto the San Diego freeway (Interstate 405) is a spectacular hotbed of bad driving practices.
During the time I was working this consulting assignment I was also mentoring a team of USC students one evening a week on building a photo-sharing mobile app that uploaded images to the cloud. One morning during a particularly harrowing commute, I came up with the idea of building a crowdsourced video database for insurance companies using a voice-activated “dashboard cam” app to capture and upload video.

So here’s the mission statement I gave this semester’s students:

*Mission is to eliminate bad drivers from the road system by providing a risk database to insurance companies so they can charge more to bad drivers. Business model is “software as a service”.*

The basic operational concept of our system is as follows:

- **Dashboard camera continuously records looping video.**
- **Voice command to mobile app (“report a bad driver”) triggers the uploading of a short video clip to a cloud database.**
- **Video/report metadata is filed by license plate number.**
- **Bad Driver reports are independently reviewed before being added to the Insurance Database to ensure accuracy.**
- **Insurance companies can query against license plate numbers to see if there are any bad driver reports logged against a vehicle while issuing policies.**

Why did we choose this approach? Let’s take it one point at a time.

We need *continuous recording looping video* because bad driving incidents happen quickly and are usually over before there’s time to get out your phone or camera to record them. So in order to report a bad driving incident you need to travel back in time around 15 or 30 seconds to show what just happened. Continuous looping video gives us a 90 second window into the past.

*Figure 5 – we need instant replay to tell if that SUV just ran a red light*
Our mobile “dashboard camera” app has to be voice activated because the last thing we want to do is to have people fiddling around with their phones while they’re driving in close proximity to a bad driver. After instructing the app to report a bad driver via voice command, a video clip is uploaded to the cloud and an email is sent to the report poster with a clickable link where they can review the video, note the license plate number, and submit a bad driver report.

**Figure 6** - say “report a bad driver” and you get an email with your video, to review when you’re not driving

Because people can make mistakes and because what constitutes bad driving is somewhat subjective in nature, **we provide for 3 independent reviews of each bad driver report before it is added to the insurance company database.** Questionable reviews are eliminated and never added to the insurance database – drivers are given the benefit of the doubt. Duplicate reports of the same incident are also detected and removed. As a possible example of who would review the reports, you can imagine driving schools requiring students to review bad driver videos before completing their instruction.

**Figure 7** - file your bad driver report at your leisure and knowing that independent reviewers will verify it
Finally after video is captured and reviewed, the video report is added to a database that can be accessed by insurance companies when issuing and renewing policies. The result being that bad drivers (and especially repeat offenders) pay more for insurance.

<table>
<thead>
<tr>
<th>License Plate #</th>
<th>State</th>
<th>Severity</th>
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<td>CA</td>
<td>3</td>
<td>CarHome</td>
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</tbody>
</table>

Figure 8 - if your report passes 3 independent reviews, it will be visible to the insurance company

We’ve built and tested all of the pieces of this solution at USC in CS590 this semester, thanks to the work of the brilliant students below, who have proven in 3 short months that the technical issues are definitely within our reach. Let’s put those cellphones that are causing deadly distracted driving accidents to better use and get the bad drivers off the road.
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