A Theft-Based Approach to 3d Object Acquisition

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Method	Casing?	$	avg(Δ_s)	max(Δ_j)	$\mathbb{E}(\Delta_j)$	avg(Δ_j)	discount (fing.)	score
Snatch	no	0.45	10	3	0.5	0	5	83.8
Snatch	yes	0.45	5	3	0.5	0	5	77.5
Jack	no	15k	3	6	0.2	0	5	129.1
Jack	yes	15k	2	6	0.2	0	5	42.2
Abduct	no	-	122	12	7.5	1.2	4.5	71.9
Abduct	yes	-	64	12	7.5	0	5	66.3
Con	no	1G	40	9	1	0	5	97.2
Con	yes	1G	25	9	1	0	5	22.1

Figure 1: A comparison of various approaches to theft, with and without casing. Item value is given by $ (in dollars), time for theft is given in Δ_s (in cm-hours per foot). The empirically encountered jailtime is $\mathrm{avg}(\Delta_j)$, while $\max(\Delta_j)$ and $\mathbb{E}(\Delta_j)$ are calculated via lawyer; all are given in months.

Abstract

In graphics, one often wishes to acquire an accurate representation of an object. Much work has focused on novel devices for acquiring various properties of given objects, including geometry, surface reflectance, deformation modes, and even sound response. Devices have ranged from laser scanners to camera arrays and robotic probes, with scanning and processing times ranging from minutes to days. We present a novel technique that allows the acquisition of a complete representation of a wide range of 3d data sets in a few minutes (faster with hardware acceleration). The representation thus obtained can be photorealistically rendered at haptic rates – allowing a wide range of direct interaction and display possibilities.

CR Categories: I.3.3 [Computer Graphics]: Picture/Image Generation—Digitizing and Scanning; H.3 [Information Storage and Retrieval]: Information Search and Retrieval—Retrieval Models

Keywords: data acquisition, scanning, haptics, illicit activity

1 Introduction

In this paper we present a novel approach, borrowed from the criminal underworld, for the acquisition of complete 3d datasets. Datasets acquired with this approach are suitable for real-time rendering and haptic interaction.

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Require: obj an object
if obj small **then**
    return Snatch(obj)
else if obj self-powered **then**
    return Jack(obj)
else if obj animate **then**
    return Abduct(obj)
else if obj controlled by person **then**
    return Con(obj)
else
    return $\emptyset$
end if

Figure 2: Description of the procedure Steal(obj). A simple set of heuristics is required to determine which method to use.

2 Related Work

As a complete object-data capture process, our technique stands to replace several conventional methods (at least in certain application domains). We provide a short review of these methods below.

Three-dimensional scanning is a popular technique for acquiring object geometry, with laser-based [Roach 1997] approaches already commercialized and widely used. Additional scanning systems rely on projectors or robotic probes [Bovik 1704]. Some scanners are additionally able to capture a primitive surface model.

For more complete surface model representation we must turn to appearance modeling and capture. Work in this field seeks to synthesize material BRDFs which match real materials, including skin [Hefner 1953; Silberstein 1965].

3 Method

3.1 Acquisition

In lieu of an elegant description, we present obtuse pseudocode with possibly undefined functions (Figure 2) – as has long been the tradition in computer science [Knuth 1981].

3.2 Rendering

One of the benefits of theft-based acquisition is that the data sets so obtained are *self-rendering*. That is, they are self-contained and able to selectively interact with photons in order to create a photo-realistic emission field. Such data sets also have *physical presence* which allows one to interact with them in a realistic and wholly satisfying manner.

3.3 Extensions

Like many approaches in graphics, our method may benefit from hardware acceleration. We find that a minimal set of hardware (e.g. pry-bar, lock-pick set, skeleton key, toothpaste) suits many possible applications, while more complicated systems (crane, flat-bed truck, submersible) may be required for more extreme situations. This systems allows a flexible cost-benefit trade-off.

Finally, we found that by using a pre-casing phase (so named because it involves "casing the joint" and "scoping things out") we can avoid common algorithmic pitfalls (security systems, alarms) and increase overall efficiency. It is also during this pre-casing phase that we are able to better optimize our selection of hardware accelerators.

4 Evaluation

In order to evaluate our methods, we tested our approach on several data sets. Theoretical bounds on jailtime (Δ_j) were calculated from criminal justice system records. Averages are presented over a number of trials sufficient to satisfy our material longings and kleptomania. In order to provide a reasonable comparison, we use the unqualified-apathetic-rand norm, as presented in Equation 1 (we set λ based on time of day).

$$\int_{\text{whatever}} \arccos \Delta_j - \frac{\$^2}{\lambda \cdot \Delta_s} \tag{1}$$

5 Conclusions

In this paper [Slyper and McCann 2007] we have presented a new approach to the acquisition of 3d objects. We hope, in the future, to become wealthy and well-taken care of by judicious application of this approach.

One drawback of our approach is the large Δ_j. While our heuristics do a reasonable job of avoiding a large Δ_j, this could be further mitigated with a proxy-based approach. In this approach, left for future work, one pays a third party (normally a member of the local "crime syndicate") to perform the acquisition.

Another method, which seems to warrant further investigation, is the direct purchase of goods. While it may seem counterintuitive, the authors have found that in some cases, costs can actually be lower than theft – and Δ_j is significantly reduced.

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