*Todo list

MSc in Computer Science 2017-18

Project Dissertation

Project Dissertation title: Reflectance Transformation Imaging

Term and year of submission: Trinity Term 2018

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Title of Degree the dissertation is being submitted under: MSc in Computer Science

Abstract

Vivamus vehicula leo a justo. Quisque nec augue. Morbi mauris wisi, aliquet vitae, dignissim eget, sollicitudin molestie, ligula. In dictum enim sit amet risus. Curabitur vitae velit eu diam rhoncus hendrerit. Vivamus ut elit. Praesent mattis ipsum quis turpis. Curabitur rhoncus neque eu dui. Etiam vitae magna. Nam ullamcorper. Praesent interdum bibendum magna. Quisque auctor aliquam dolor. Morbi eu lorem et est porttitor fermentum. Nunc egestas arcu at tortor varius viverra. Fusce eu nulla ut nulla interdum consectetuer. Vestibulum gravida. Morbi mattis libero sed est.

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1.2 Background in Computer Science

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Related work intro

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Workflow Comparisions

2.2 Fileformats

The most comprehensive overview on the current state of the art is done by the American library of congress as part of its Digital preservation effort, with the sections on the ptm[1] and rti[2] formats. The current PTM specification by Malzbender and Gelb[4].

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Size tables/graphes of ptm/rti/btf(.zip)

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Viewer Comparision

Todo Text:
No extensible architecture

Todo Text:
No real open source (email before or one file sources)

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Todo Text:
Camera Theory

3 Methodology

Exploratory piece of work

3.1 Requirements

Todo Text:
Requirements Analysis, informal discussion

3.2 Architectural Design

Todo Text:
Architecture Picks

4 Requirements and Design

4.1 Functional Requirements

Distilling these, I arrived at the following functional requirements:

1. thing
2. thing
3. Runnable on all major operating systems.
4. Easy installation for researchers.

Todo Text:
Functional Requirements

Todo Text:
Concrete file formats

Todo Text:
Concrete lightning models

Todo Text:
Concrete usability features

4.2 Non-Functional Requirements

Continuing the enumeration of the functional requirements, following functional requirements were extracted:

5. Free Software, the implementation should be available for everyone to change and distribute.
6. Easy on-boarding of new developers, either scientists in a research context or students in an education context.
7. Good developer experience.
8. Adequate performance, at least keeping up with current implementations.

Todo Text:
Non-Functional Requirements

Todo Text:
Interactivity

4.3 State-Driven

Todo Text:
State-Driven

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Plugins

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Rendering Stack

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Workflow comparison

json

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5 Implementation

5.1 Overview

This section explains the current implementation of the developed tool set, it is primarily targeted to fulfill the dissertation's requirements. But is also aiming to be helpful for users wanting to understand the underlying systems and prepare them for potentially joining the development effort. Abridged code extracts are used as of their state for thesis submission, while the main principles will hold, later readers are asked to please consult the actual source code if any discrepancies arise or reexport the document. First the main libraries are shortly explained in their relevance to the program, second the largely abstract plugin architecture is shown, third the main plugins are presented and last the delivery processes to the end users are described.

All implementation files are contained and delivered inside a single git repository, which is freely available online: `https://github.com/ksjogo/oxrti`. All following file paths are relative to that repository's root. All future development will be immediately available there and the current compiled software version is always fed automatically from it into the hosted version at `https://oxrtimaster.azurewebsites.net/api/azurestatic`.

5.2 Libraries

TypeScript: The official header line of TypeScript show some points why it was picked for this project: "TypeScript is a typed superset of JavaScript that compiles to plain JavaScript. Any browser. Any host. Any OS. Open source."[9] Which fits requirements 5, 3. Whereas plain JavaScript would have allowed slightly easier initial on-boarding and maybe easier immediate code 'hacks', TypeScript will provide better stability in the long run and a quite improved developer experience (requirement 7) in the long run. With the full typed hook system (compare section 5.4) it ensures that a compiled plugin will not have

runtime type problems, reducing the amount of switching between code editor and the running software. The whole project is setup in a way to fully embrace editor tooling, Visual Studio Code[10] and Emacs[3] are the 'officially' tested editors of the project. Code is recommended as it will support all developer features out of the box. The installation of the tslint[7] plugin[8] is recommended to keep a consistent code style, which is configured within the *tslint.json* file.

React **Todo Text:** React

mobx **Todo Text:** mobx

mobx-state-tree **Todo Text:** mobx-state-tree

gl-react **Todo Text:** gl-react

webpack **Todo Text:** webpack

[6]

electron **Todo Text:** electron

misc **Todo Text:** misc

[5]

5.3 Plugin architectures

Todo Text: Plugin architectures

```
1   function murks() : number{}
```

5.4 Hooks

The hook system allows stable and prioritized interactions between the different plugins. All available hooks are declared inside the Hook.tsx file, which offers 3 different types of hooks:

```
// Hooks are sorted in descending priority order in their respective `HookManager`
export type HookBase = { priority?: number }

// Generic single component hook, usually used for rendering a dynamic list of components
export type ComponentHook<P = PluginComponentType> = HookBase & { component: P }

// Generic single component hook, usually used for notifications
export type FunctionHook<P = (...args: any[]) => any> = HookBase & { func: P }

// Generic hook config, requiring more work at the consumer side
export type ConfigHook<P = any> = HookBase & P

// union of all hooks to allow for manual hook distinction
export type UnknownHook = ComponentHook & FunctionHook & ConfigHook

// object of named hooks
type Hooks<P> = { [key: string]: P }

// collection of unknown hooks
export type UnknownHooks = Hooks<UnknownHook>

// hook configuration inside plugins:
// 1-Hookname->*-LocalName->1-HookConfig
export type HookConfig = { [P in keyof HookTypes]: Hooks<HookTypes[P]> }

// all hooknames
export type HookName = keyof HookConfig
```

```
27
28 // map one hookname to its type
29 export type HookType<P extends HookName> = HookTypes[P]
30
31 // list of hooknames inside hook collection T, having
   ↪  hooktype U
32 type LimitedHooks<T, U> = ({ [P in keyof T]: T[P] extends U ? P
   ↪  : never })[keyof T]
33
34 // limit hookname parameters to a type conforming subset,
   ↪  e.g. LimitedHook<ComponentHook>
35 export type LimitedHook<P> = LimitedHooks<HookConfig, Hooks<P>>
```

These types are used to first declare single hook types (which will be discussed within the plugins consuming them) and then construct the whole hook configuration tree for all plugins:

```
type HookTypes = {
  ActionBar?: ConfigHook<ActionBar>,
  AfterPluginLoads?: FunctionHook,
  AppView?: ComponentHook,
...
}
```

5.5 BTF File Format

This section describes the BTF file format. The aim of this file format is to provide a generic container for BTF data to be specified using a variety of common formats. Files shall have the `.btf.zip` extension.

5.5.1 File Structure

A BTF file is a ZIP file containing the following:

- A **manifest** file in JSON format, named `manifest.json`. The manifest contains all information about the BRDF/BSDF model being used, including the names for the available **channels** (e.g. `R`, `G` and `B` for the 3-channel RGB), the names of the necessary **coefficients** (e.g. biquadratic coefficients) and the **image file format** for each channel.

- A single folder named `data`, with sub-folders having names in 1-to-1 correspondence with the channels specified in the manifest.
- Within each channel folder, greyscale image files having names in 1-to-1 correspondence with the coefficients specified in the manifest, each in the image file format specified in the manifest for the corresponding channel. For example, if one is working with RGB format (3-channels named `R`, `G` and `B`) in the PTM model (five coefficients `a2`, `b2`, `a1`, `b1` and `c`, specifying a bi-quadratic) using 16-bit greyscale bitmaps, the file `/data/B/a2.bmp` is the texture encoding the `a2` coefficient for the blue channel of each point in texture space.
- The datafiles are all in reversed scanline order (meaning from bottom to top), to keep aligned with the original PTM format and allow easier loading into WebGL.

5.5.2 Manifest

The manifest for the BTF file format is a JSON file with root dictionary. The `root` element has two mandatory child elements: one named `data`, and one named `name` with the option of additional child elements (with different names) left open to future extensions of the format.

- The `name` element is a string with a name of the contained object.
- The `data` element has for entries, named `width`, `height`, `channels` and `channel-model`. The `width` and `height` attributes have values in the positive integers describing the dimensions of the BTDF. The `channel-model` attribute has value a non-empty alphanumeric string uniquely identifying the BRDF/BSDF colour model used by the BTF file (see Options section below). The `channels` element has an arbitrary amout of named `channel` entries, according to the `channel-model`. * Additionally the `data` element has one untyped entry named `formatExtra`, where format implementation specific data can be stored.
- Each `channel` has an `coefficents` child consisting of an arbitrary number of `coefficent` entries, as well as one `coefficient-model` attribute. The `coefficient-model` attribute has value a non-empty alphanumeric string uniquely identifying the BRDF/BSDF approximation model used by the BTF file (see Options section below). * Each `coefficient` element has one attribute: `format`. The `format` attribute has value a non-empty alphanumeric string uniquely identifying the

image file format used to store the channel values (see Options section below).

5.5.3 Textures

Each image file `/data/CHAN/COEFF.EXT` has the same dimensions specified by the `width` and `height` attributes of the `data` element in the manifest, and is encoded in the greyscale image file format specified by the `format` attribute of the unique `coefficient` element with attribute `name` taking the value `COEFF` (the extension `.EXT` is ignored). The colour value of a pixel `(u,v)` in the image is the value for coefficient `COEFF` of channel `CHAN` in the BRDF/BSDF for point `(u,v)`, according to the model jointly specified by the values of the attribute `model` for element `channels` (colour model) and the attribute `model` for element `coefficients` (approximation model).

5.5.4 Options

At present, the following values are defined for attribute `channel-model` of element `channels`.

- `RGB`: the 3-channel RGB colour model, with channels named `R`, `G` and `B`. This colour model is currently under implementation. * `LRGB`: the 4-channel LRGB colour model, with channels named `L`, `R`, `G` and `B`. This colour model is currently under implementation.
- `SPECTRAL`: the spectral radiance model, with an arbitrary non-zero number of channels named either all by wavelength (format `---nm`, with `---` an arbitrary non-zero number) or all by frequency format `---Hz`, with `---` an arbitrary non-zero number. This colour model is planned for future implementation.

At present, the following values are defined for attribute `model` of element coefficients, where the ending character `*` is to be replaced by an arbitrary number greater than or equal to 1.

- `flat`: flat approximation model (no dependence on light position). This approximation model is currently under implementation.
- `RTIpoly*`: order-`*` polynomial approximation model for RTI (single view-point BRDF). This approximation model is currently under implementation.

- `RTIharmonic*`: order-`*` hemispherical harmonic approximation model for RTI (single view-point BRDF). This approximation model is currently under implementation.
- `BRDFpoly*`: order-`*` polynomial approximation model for BRDFs. This approximation model is planned for future implementation.
- `BRDFharmonic*`: order-`*` hemispherical harmonic approximation model BRDFs. This approximation model is planned for future implementation.
- `BSDFpoly*`: order-`*` polynomial approximation model for BSDFs. This approximation model is planned for future implementation. * `BSDFharmonic*`: order-`*` spherical harmonic approximation model for BSDFs. This approximation model is planned for future implementation.

At present, the following values are defined for attribute `format` of elements tagged `coefficient`, where the ending character `*` is the bit-depth, to be replaced by an allowed positive multiple of 8.

- `BMP*`: greyscale BMP file format with the specified bit-depth (8, 16, 24 or 32). Support for this format is currently under implementation.
- `PNG*`: PNG file format encoding the specified bit-depth (8, 16, 24, 32, 48 or 64). Support for this format is currently under implementation. Different PNG colour options are used to support different bit-depths: * `Grayscale` with 8-bit/channel to encode 8-bit bit-depth. * `Grayscale` with 16-bit/channel to encode 16-bit bit-depth. * `Truecolor` with 8-bit/channel to encode 24-bit bit-depth. * `Truecolor and alpha` with 8-bit/channel to encode 32-bit bit-depth.
- `Truecolor` with 16-bit/channel to encode 48-bit bit-depth.
- `Truecolor and alpha` with 16-bit/channel to encode 64-bit bit-depth.

5.6 Loader

5.7 State Management

Todo Text:
state management

Todo Text:
state import/export

Todo Diagramm:
redux

Todo Diagramm:
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5.8 Components

Todo Text:
single component units

5.9 Renderer Stack

Todo Text:
base rendering nodes

Todo Diagramm:
stacked components

Todo Diagramm:
effects

5.10 Plugins

Todo Text:
Plugins API

5.10.1 TabView Plugin

```
type Tab = {
    content: PluginComponentType
    tab: TabProps,
    padding?: number,
```

```
    beforeFocusGain?: () => Promise<void>,
    afterFocusGain?: () => Promise<void>,
    beforeFocusLose?: () => Promise<void>,
    afterFocusLose?: () => Promise<void>,
}

type ActionBar = {
    onClick: () => void,
    title: string,
    enabled: () => boolean,
    tooltip?: string,
}

type ViewerTabFocus = {
    beforeGain?: () => void,
    beforeLose?: () => void,
}

type ScreenshotMeta = {
    key: string,
    fullshot?: () => (string | number)[] | string | number,
    snapshot?: () => (string | number)[] | string | number,
}

type ViewerFileAction = {
    tooltip: string,
    text: string,
    action: () => Promise<void>,
}
```

5.10.2 Converter Plugin

Todo Text:
Converter Plugin

5.10.3 PTMConverter Plugin

Todo Text:
PTMConverter Plugin

5.10.4 Renderer Plugin

```
type BaseNodeConfig = {
    channelModel: ChannelModel,
    node: PluginComponentType<BaseNodeProps>,
}

type RendererNode = {
    component: PluginComponentType,
    inversePoint?: (point: Point) => Point,
}

type MouseConfig = {
    listener: MouseListener,
    mouseLeft?: () => void,
}
```

Todo Text:
Renderer Plugin

Todo Text:
Base Node

Todo Text:
WebGL texture packing

5.10.5 PTM Renderer Plugin

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PTM Renderer Plugin

Todo Text:
Dynamic Shaders

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Light Control Plugin

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Zoom Plugin

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Todo Text:
Automatic Import Export

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Todo Text:
Other related graphics

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Standalone Website

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Community Onboarding

7.2 Novelties

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Novelties results

7.3 Future Work

Todo Text:
Future Work

8 Conclusion

Todo Text:
Conclusion

References

[1] Library of Congress. *Polynomial Texture Map (PTM) File Format*. June 14, 2018. URL: https://www.loc.gov/preservation/digital/formats//fdd/fdd000487.shtml (visited on 08/10/2018).

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