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A Very Good Title

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Abstract

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Acknowledgements

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Tuesday 11th January, 2022

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Chapter 1

Introduction

1.1 Background

In this section we summarize some key papers and their significance to the project.

We may also include a brief introduction to HoTT, but maybe that's better suited to 2.

1.1.1 A Categorical Theory of Patches

A Categorical Theory of Patches [**Categorical2013**] defines a category of files and patches, such that a merge is a pushout. To ensure a merge is always possible they first construct the category $\mathcal{L}$ of files and patches, and then its conservative cocompletion $\mathcal{P}$.

$\mathcal{P}$ contains all finite colimits – and in particular all pushouts – so the merge of a span is always defined. The paper's chief achievement is the explicit construction of this category and these pushouts.

Interesting insights I'm not sure how to incorporate:

- the construction of $\mathcal{P}$ can be understood as the addition of *partially* ordered files to $\mathcal{L}$.
- "flattening" these partial orders leads to cyclic graphs. On editing text [**editing2014**] objects, but maybe not correctly
- the poset structure of $\mathcal{L}$ and $\mathcal{P}$ is given explicitly by $\mathcal{G}$ and the nerve functor $N_{\_}$ (!!).

(maybe some figures go here)

1.1.2 Patch Theory (Darcs)

Here we discuss several proposed formalisms for a the patch theory employed by Darcs [**Darcs**]. [**Lynagh2006**, **Sittampalam2005**, **Dagit2009**] all attempt to describe Darcs' patch theory. (focus on Lynagh, I think)

1.1.3 Homotopical Patch Theory

Homotopical Patch Theory [**Angiuli2016**] gives a formulation of patch theory in homotopy type theory. A patch theory is represented by a higher inductive type, and its interpretation by a function out of this type.

By representing repository state as points and patches as paths in a higher inductive type, the groupoid structure of the patch theory comes "for free". Paths come with composition, and by the groupoid laws this composition is associative, unital, and respects inverses. Additionally, functions (functors?) respect this structure so any interpretation must also validate the groupoid laws.

Patch laws are represented by paths between paths (squares? disks? 2D-somethings). For example we may want the application of two independent patches to commute – this is done with a patch law.

While the HIT formulation gives a lot "for free", it also has some drawbacks. In particular, the requirement that all patches have inverses causes some problems. The workaround is to "type" patches with the history they are applicable to. This allows Angiuli et al. to define a merge operation in terms on only the "forward" patches, but leads to a fairly complex theory even for relatively simple settings.

An interesting feature of Angiuli et al.'s patch theories is that the type of repositories must be contractible. Since patches are represented by paths, any point can be retracted along them. As such, all repositories are – in a sense – "the same" and we need better notions of "sub-homotopical" [**Angiuli2016**] computations to reason about their differences.

1.1.4 Path Spaces of Higher Inductive Types

Path Spaces of Higher Inductive Types in Homotopy Type Theory [**kraus2019path**] provides an induction principle for paths in coequalizers. This is extremely useful, since we want to define functions out of spans in HITs. (← rework this sentence)

Summarizing this will be very technical, and may become its own chapter if I successfully formalize the proof in cubical agda. Otherwise it goes here.

Chapter 2

Homotopy Type Theory

It's cool. [**hottbook**]

Chapter 3

Version Control Systems

They're not always cool. [**git-inconsistent**]

Chapter 4

Conclusion

We did some things and they worked out — or maybe they didn't.

Appendix A

This is an appendix, if need be