Using Artificial Intelligence for Planning and Imposition

Tyler Thompson | Tilia Labs Inc.
TAGA - Spring 2020

About Me
- B.S. Degree Clemson University | Graphic Communications (2012)
- InterTech Award Recipient | 2019 (True-AI)
- Esko-Graphics | Sales (2012-2018)
- Tilia Labs Inc. | Director, Solutions (2018-Present)
- Based in Charleston, South Carolina

Tyler Thompson | Tilia Labs Inc.
TAGA - Spring 2020

Using Artificial Intelligence for Planning and Imposition

Tyler Thompson | Tilia Labs Inc.
TAGA - Spring 2020

InterTech Award | True-AI

InterTech Technology Awards
- Honors the development of innovative technologies in Graphic Arts
- Printing Industries of America (non profit trade association)
- World's largest graphic arts trade association

2019 Recipients
- True-AI
- HP PageWide True Water-Based Inks
- HP PrintOS Color Beat
- Kodak Flexcel NX Ultra Solution
- Canon Solutions America
- Hybrid Software Hybrid VDP

Judge's Comments
- Real AI used at an appropriate point and in an appropriate way. Game changing in that you could submit a design and it could go right to print without anyone else touching it!

About Tilia Labs

SOFTWARE COMPANY
- Founded in Ottawa, Canada
- Small highly skilled development team
- Agile development process, short release cycles
- Over 500 licenses sold YTD
- Global distribution in over 32 countries

PRODUCTS
- tilia Phoenix
- tilia Griffin
- tilia Aries
- tilia Cloud

Customer Markets
- DeepFace
- DeepFace
- AlphaGo
- AlphaGo
- ADAS
- LG & Mercedes

About Tilia Labs
**Imagery:**

- **Artificial General Intelligence**
  - PathAI
  - Human pathologists:
    - 300 slides per day
    - 1 slide per minute
    - 50,000 cells per slide
    - Error rate between 10-15%

- **Imagenet**
  - AI learns like a human
  - Humans tagged millions of photos
  - AI began recognizing patterns
  - With more advanced training, AI understands context

- **Driving**

- **Investment**

- **People Management**

- **Social Interaction**

- **Musical Composition**

- **Book Writing**

- **Programming**

- **Theorem Proving**

- **AI Design**

- **Science**

- **Artificial General Intelligence**

- **PathAI**

- **Imagenet**

- **PathAI**

- **Imagenet**

- **PathAI**
**PathAI**

**Machine pathologist:**
- 30,000+ slides per day
- 1 slide per second
- 0.6% error rate
- Can work alongside its human counterpart to close error rate to 0%

**More Facts**
By 2020, artificial intelligence will create more jobs than it eliminates
- One in 25 CEDs have deployed AI
- 31% say they plan to in < 12 months
- 72% of CEOs adopting AI deem it a "competitive advantage"
- $2.9 Trillion business value by 2021

**Human Planning**
- Manual process (rubber cement)
- 2-3 days of production planning
- 1 day of CAD work
- 1 hour to impose a template

**Let's Plan a Job!**

**...is this the most optimized form?**
...or this?

What About Nesting?

Result Using Lay Flat

Result Using Shape

Let’s Plan More!

Planning Variables

<table>
<thead>
<tr>
<th>Planning Variables</th>
<th>12</th>
<th>1000</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sets</td>
<td>12</td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>Quantities</td>
<td>500</td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>Presses</td>
<td></td>
<td>1000</td>
<td>12</td>
</tr>
<tr>
<td>Machines</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Colors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Places</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finishing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Office</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sizes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digits</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Over 45,000,000,000 possible combinations!
Why is this important?

Packaging Trends
- During 2016 some 40,000 CPG products came to market, more than twice as many as in 1998.
- Suave now has eight times as many unique SKUs as it had in 2007.
- There is now a greater variety of labels in shorter run lengths than ever before.

Printer/Converter Challenges
- Shorter run lengths
- Increase number of SKU's
- Faster turn-around
- Decrease costs

Introducing: Imposition AI

The industry’s first artificially intelligent planning algorithm

Why employ AI to help?

Technology - How is AI used?
- A simple algorithm to search the Plan tool
- Intelligent algorithms to search the Plan space
- Hybrid algorithms to search the Plan space
- Algorithms that operate in a variety of customer and home grown jobs
- Offline: Allows Plan to choose the best algorithms and algorithm-specific hyperparameters to use by classifying incoming jobs using models that were previously trained using existing customer and home grown jobs.
- Online: Occurs while application is running and the success of the planning algorithms/hyperparameters becomes known in the “real world”

What does good look like?
- Offline models used to select algorithms and algorithm specific hyperparameters
- Adapt to production trends as they are generated (i.e. variable 24/7 lines)
- Utilize customer examples and home grown jobs
- Faster planning times and consistently higher quality results

Intelligent Searching
ONLINE LEARNING
- Driven while Phoenix is running to determine success or failure
- Results become known in the "real-world"
- Reinforcement learning techniques adapt the models
- Models learn to make quality even with complex nested jobs
- Dynamically adjust for unexpected scenarios not well represented in offline training sets

Comparative Analysis

One more time... 1/10 speed

Folding Carton Case-Study

Press-side Planning
- Just-in-time is challenging
- Predicting demand is nearly impossible
- Imposition AI enables JFT planning at the press
- Operators can ask Phoenix for jobs approaching a due date and Phoenix returns imposed jobs
Artificial Intelligence is here.
Are you ready?