**Evaluating Automated Programming Tools for a Technology Startup**

**Introduction:**

The purpose of this documentation is to provide a comprehensive overview of the evaluation of automated programming tools for a technology startup. As an outside consultant, the goal was to assess the potential of automated code generation, AI-assisted programming, and AI-generated code in reducing programming workload and costs.

**Methodology:**

The evaluation process involved the following steps:

* **Selection of Tools:**
  + Identified code generators in the Go ecosystem (e.g., standard library generate, jennifer package).
  + Chose GitHub Copilot for AI-assisted programming but since Github Copilot is not free, I used Codeium. Codeium is the modern coding superpower, a **free code** acceleration toolkit built on cutting edge AI technology. Currently, Codeium provides code completion tool in over 70+ languages, with lightning fast speeds and state-of-the-art suggestion quality.
  + Selected ChatGPT as the LLM-based service for AI-generated code. Provided it with a prompt and it generated code how I wanted.
* **Application to Assignment:** 
  + Applied each method to the ‘Go For Statistics’ assignment, which involved statistical analysis using the Anscombe Quartet data.

**Automated Code Generation:**

**Tools Examined:**

* Go standard library **generate**
* **jennifer** package

**Approach:**

* Explored the capabilities of code generators to automate repetitive tasks.
* Investigated the possibility of generating unit tests for statistical functions.

**Code Samples:**

* Example of code snippet generated for unit test: Automated\_Code\_Generation/test\_generator.go and Automated\_Code\_Generation/main\_test.go.
* Test\_generator.go has the logic defined for generating test units for the main.go using **Jennifer** package. In this code, I used **Jennifer.**

**AI-assisted Programming:**

**Tool Used:**

* Codeium

**Approach:**

* Integrated Codeium with VS Code for real-time assistance.
* Utilized Codeium’s suggestions to revise existing code and improve efficiency.

**Results:**

* Improved readability and efficiency of code snippets through Codeium’s recommendations.
* Example of before-and-after code snippets: AI\_Assisted\_Programming/main.go is before and AI\_Assisted\_Programming/main\_revised.go is after.

**AI-generated Code:**

**Service Used:**

* ChatGPT (on free plan)

**Approach:**

* Engaged in a dialogue with ChatGPT to generate Go code for statistical analysis.
* Explored various prompts and evaluated the quality of generated code.

**Results:**

* Generated code snippets for statistical functions based on ChatGPT's responses.
* Example conversation with ChatGPT: Generate Go code for linear regression analysis on the Anscombe data set. Make it clean, optimized and readable.

**Evaluation:**

**Effectiveness:**

* Automated code generation tools provided some level of assistance in streamlining development tasks.
* Codeium significantly improved code quality and productivity by providing context-aware suggestions.
* ChatGPT demonstrated the potential to generate code snippets but may require refinement for specific use cases.

**Limitations:**

* Code generators may not cover all edge cases and require manual intervention for complex scenarios.
* AI-assisted programming tools like Copilot and Codeium may lack domain-specific knowledge and provide generic suggestions.
* AI-generated code from ChatGPT may not always meet the requirements and require human validation.

**Recommendations:**

Based on the evaluation, the following recommendations are proposed:

* Implement GitHub Copilot and Codeium etc for AI-assisted programming to enhance productivity and code quality.
* Use automated code generation tools selectively for repetitive tasks but maintain human oversight for complex scenarios.
* Explore further refinement of AI-generated code tools to align with specific project requirements.

**Conclusion:**

The evaluation of automated programming tools revealed promising opportunities to enhance the efficiency of software development processes. By leveraging AI-assisted programming and code generation tools, the startup can optimize resource utilization and accelerate product development while maintaining code quality.

**References:**

* GitHub Copilot
* ChatGPT
* Go standard library
* Codeium
* Jennifer package for Go