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Unlock the power of AI to net visual bugs

Credits

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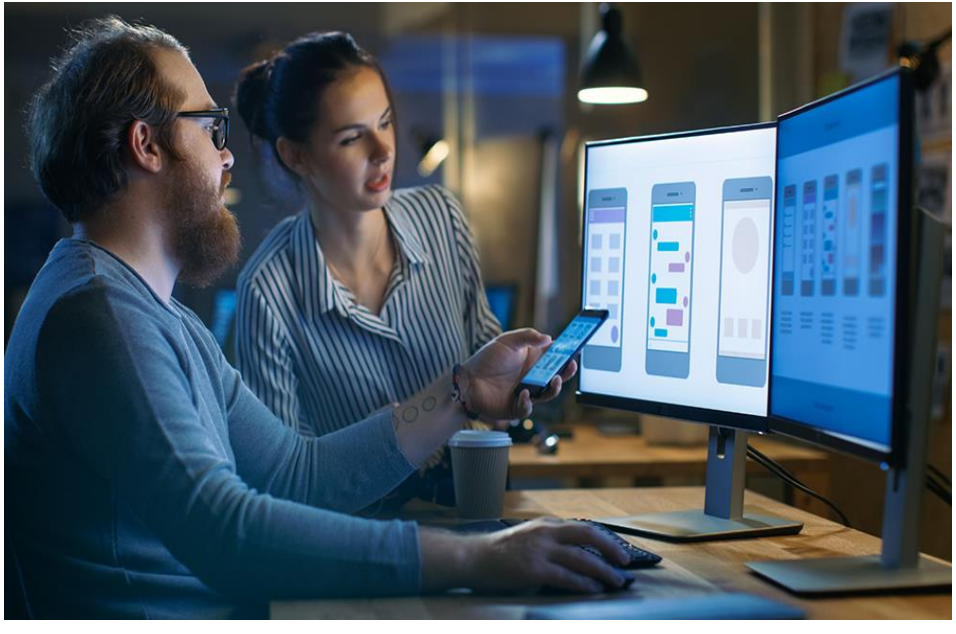
Visual bugs slipping through manual testing: A threat to user experience



"**61% of enterprise IT leaders responded that end-user experience** is critical for application performance monitoring." – Gartner

"**67% of businesses perform visual testing manually to detect visual bugs.**" - Browser stack

Major challenges faced in manual visual testing today

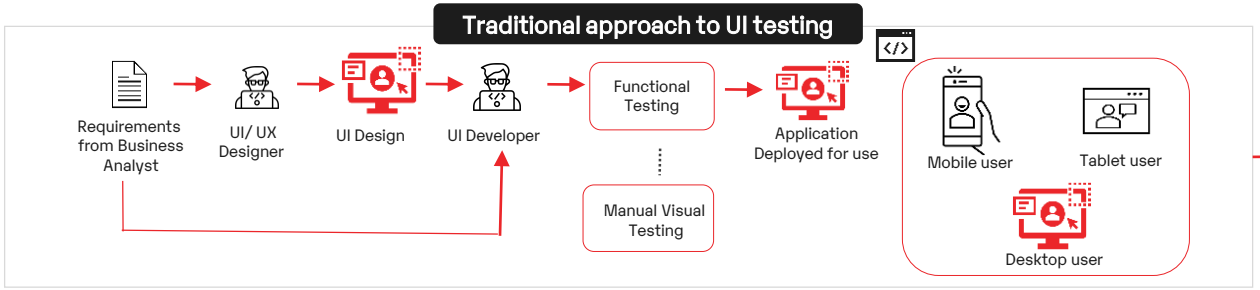
- Multiple aspects of the UI must be verified thoroughly
- Frequent UI changes lead to prolonged visual testing
- Inconsistency in UI across multiple platforms

Impacts of manual visual testing

Higher error rate | Delayed test execution | Increased operational costs | Lower accuracy

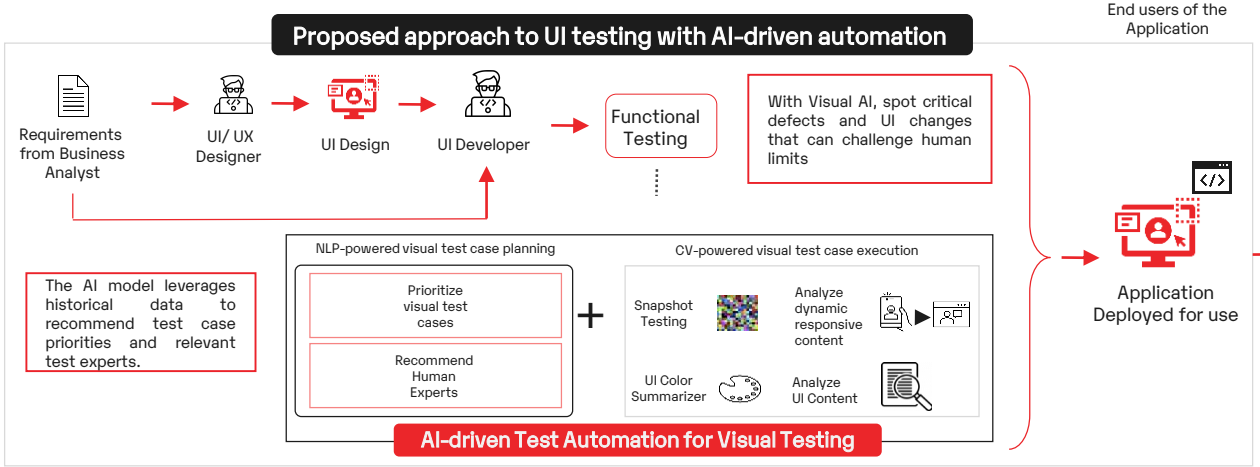
AI-driven test automation for visual testing: Detect and fix visual bugs faster to enrich the end-user experience

"60% of organizations can detect bugs faster due to increased test coverage using AI-driven test automation." - Global Quality Report



With the traditional approach:

- Prolonged test execution
- Minimal test coverage
- Inconsistency in end-user experience



With the proposed approach:

- Faster detection and redressal of visual bugs
- Accelerated test case execution
- Enriched end-user experience

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Three-step approach to AI-driven test automation for visual testing

01

NLP-based visual test case prioritization and recommendation of the right visual test expert

- Automate test case prioritization and test expert recommendations, using historical data from past sprints

02

Computer vision (CV) powered visual test case execution for identifying visual bugs

- Review the UI design for visual issues via comparison, component rendering, color stats, and content awareness

03

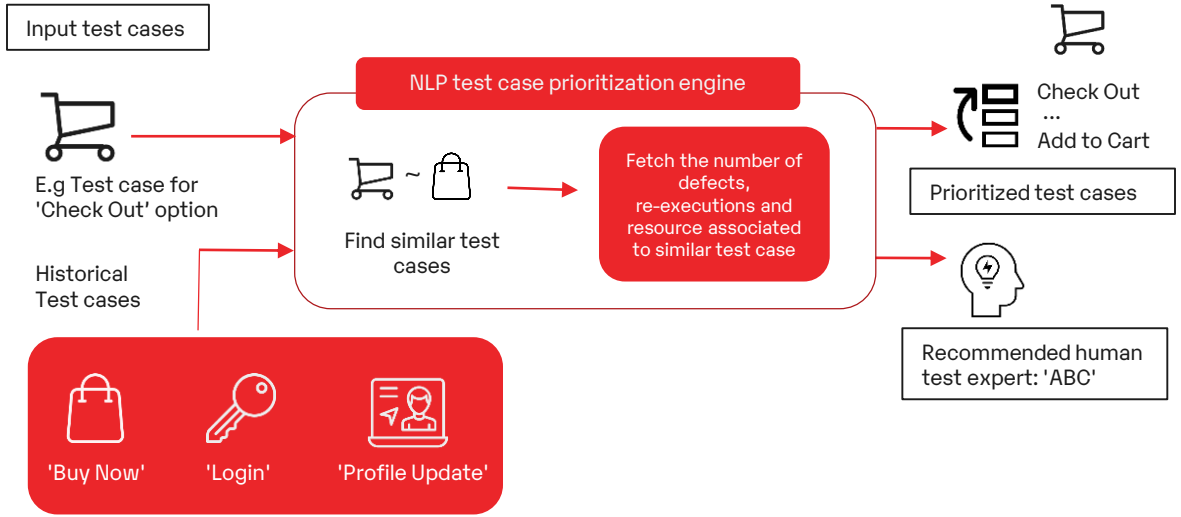
Automated testing and rapid feedback integration to enable CI/CD

- Collect bug reports and feedback from testers and analysts, and forward them to the development team for resolution

AI-driven test automation enhances test coverage and reduces the test execution time. This also yields a very high accuracy, irrespective of the technology used for UI development.

NLP-based visual test case prioritization and recommendation of the right visual test expert

The NLP model leverages historical test cases derived from past sprints to assign test case priorities and recommend a visual test automation expert.



NLP-powered test case prioritization and test expert recommendation (sample scenario)

Recommendations

- Implement NLP engines such as **BERT, GenSim, and NLTK** to find similar test cases based on visual test case description
- Categorize test cases as **'High', 'Medium',** or **'Low' and tag them** based on the priority and re-execution of similar historical test cases
- Leverage the human expert associated with similar visual test cases in the past, for scalable and accurate visual test results

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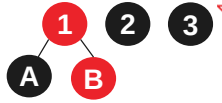
Sample use case: Test case prioritization and test expert recommendation



Historical test cases from various sprints are fed into the NLP engine to derive the test case priorities and recommendations of the testing expert, for the new test cases.

NLP-powered test case execution showing priority for test cases and recommending test expert

Test Case	Similarity Score	Current Release Resource	Resource_Allocation	User Story Priority
Verify the Agent is logged in to...	0.5378400087	Bhuva	Harish,Kavya,Manoj	High
Validation of Prefetch Custome...	-0.055133108	Pooja	Harish,Kavya,Manoj	High
Verify user able to view two but...	0.4541432559	Manoj	Pooja,Harish,Kavya,Manoj	High
Validate if the agent is able to s...	0.4070736468	Priya	Vishnu,Kaberi,Pooja,Kavya	Medium
Validate if the agent is able to s...	0.8729862571	Bhuva	Bhuva	Medium
Validate if the agent is able to s...	0.540691793	Bhuva	Kavya,Manoj	Medium
Validate if the agent is able to s...	0.4103612304	Kaberi	Pooja,Kaberi,Kavya	Medium
Validate if the agent is able to s...	0.4782224894	Bhuva	Vishnu,Kavya	Medium
Validate if the agent is able to s...	0.6064353585	Kaberi	Vishnu,Kavya	Medium
Validation of Pega login by Age...	0.2856173515	Laxmi	Semmalar,Kavya,Laxmi	Medium
Validation of Pega login by Age...	0.7396883368	Bhuva	Bhuva	Medium
Validation of CTI Login	0.6373349428	Laxmi	Laxmi	Medium
Validation of Phone ICON	0.1152824387	Udhaya	Manoj,Semmalar,Kavya,Pooja,Vi...	Medium

Columns Filters

NLP-powered test case prioritization can improve the overall speed of visual testing, accelerating time-to-innovate and time-to-market.

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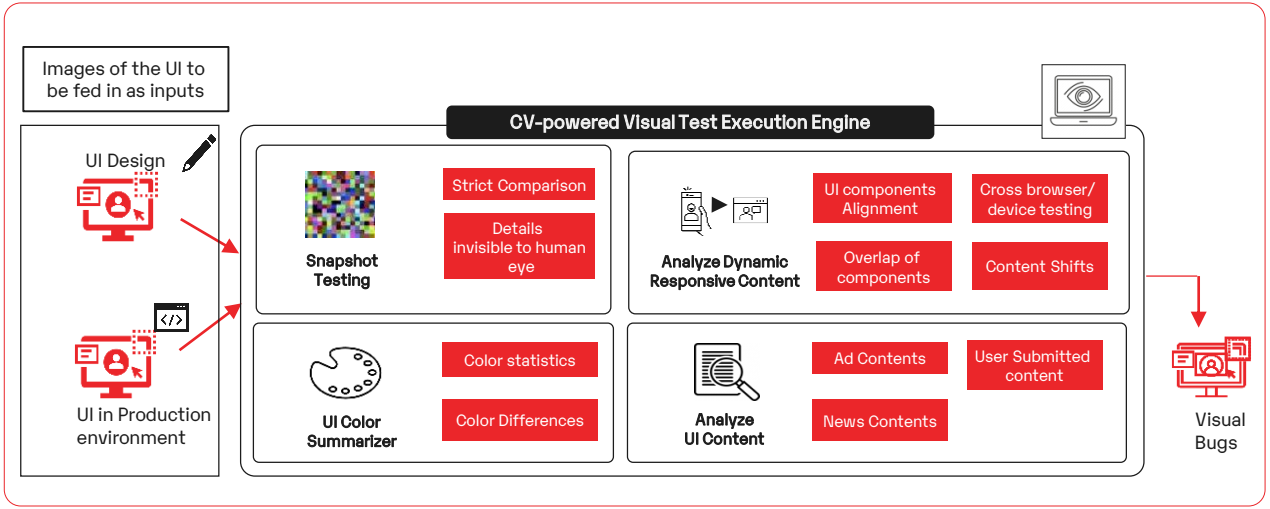
Computer vision (CV) powered visual test case execution for identifying visual bugs

Implement Computer Vision (CV) powered test execution engine to process images and videos. Monitor parameters such as blocked/overlayed UI components, ads blocking the UI components, the responsiveness of visuals across devices, etc.



- Choose '**Snapshot Testing**' or 'Analyze UI Content' for detecting visual bugs
- Choose '**Analyze Dynamic Responsive Content**' option, for analysis on content placement, content awareness etc.
- Choose the '**UI color summarizer**' to perform a color comparison between the UI design and the actual UI.

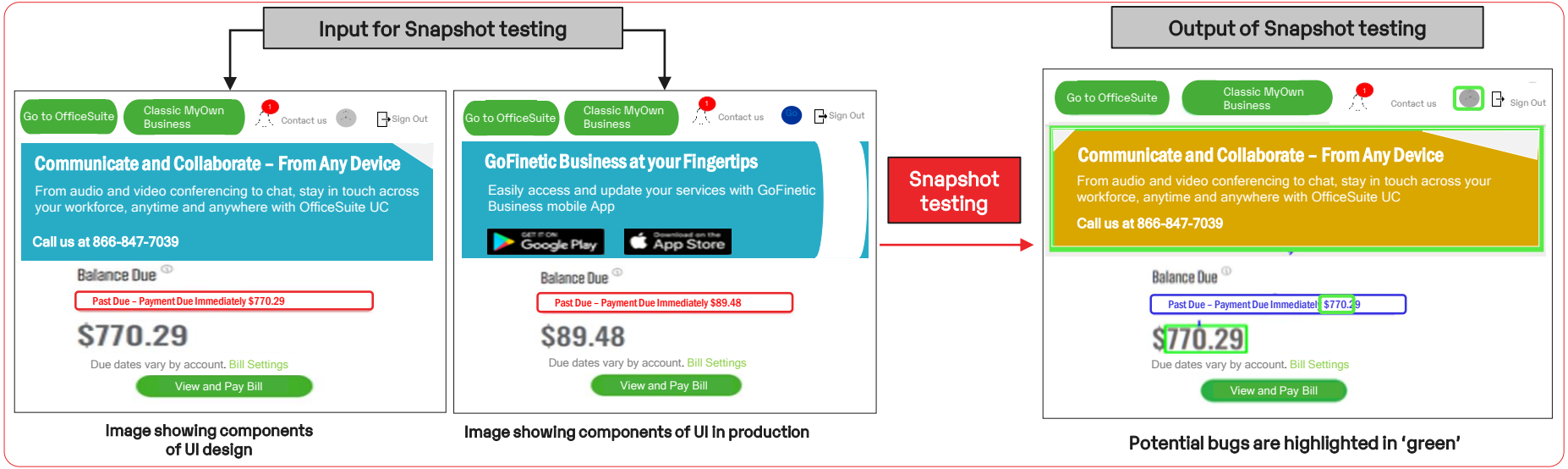
With automated visual testing, the overall accuracy in spotting and fixing visual bugs can be improved by 90%

Recommendations

- Perform a stringent pixel-to-pixel comparison for snapshot testing between UI in production and UI design
- Leverage techniques like **Scale Invariant Feature Transform (SIFT)**, for inspecting dynamic content such as component alignment across devices, cross-browser testing, etc.
- Implement the UI colour summarizer that uses toolboxes such as **Colortheif** to reveal the dominating colours, difference in colours in UI against design
- Perform UI contents analysis, that uses packages such as **Easyocr** and **Pytesseract** to help improve the awareness of UI content, check on the relative placement as well as differences in the content, etc.

Sample use case: Snapshot comparison of UI in production with the UI design

Snapshot testing takes an image of the UI and renders the components into text (a snapshot) for comparison to detect potential bugs. The test will fail when the two snapshots do not match, due to the unexpected UI changes. This indicates a potential visual bug, and these bugs are highlighted for redressal.



CV-powered test execution engine helps achieve 90% better accuracy than manual visual testing.

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Automated testing and rapid feedback integration to enable CI/CD

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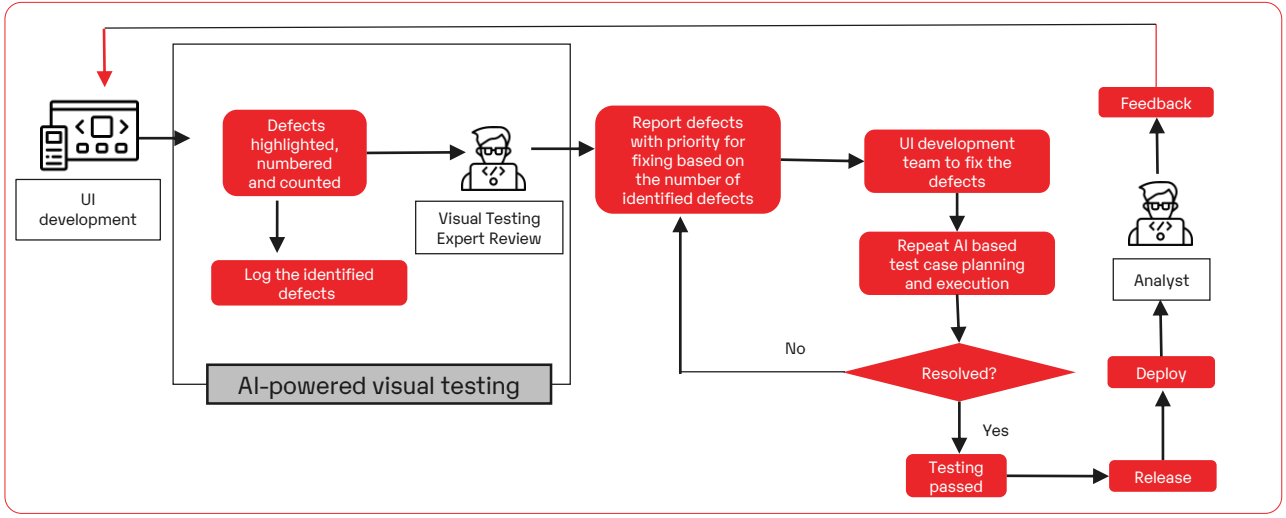
Post AI-driven automated visual testing, the application goes into deployment, where an analyst keeps a check and provides regular rapid feedback messages to the development team on the UI changes that were done.



Recommendations

- Validate automated visual test results with a human test expert recommended by the system
- Leverage **Jira** for reporting visual bugs and highlighting them for redressal
- Implement **Azure DevOps (ADO)** for performing automated build and release management

Implementation of AI-powered visual testing accelerates visual testing by 83%.

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Business benefits unlocked by a leading service provider in North America

83% acceleration in visual testing

75% reduction in operating costs for test case execution

90% improvement in accuracy when compared to manual visual testing

60% improvement in test coverage

Thank you

Annexure

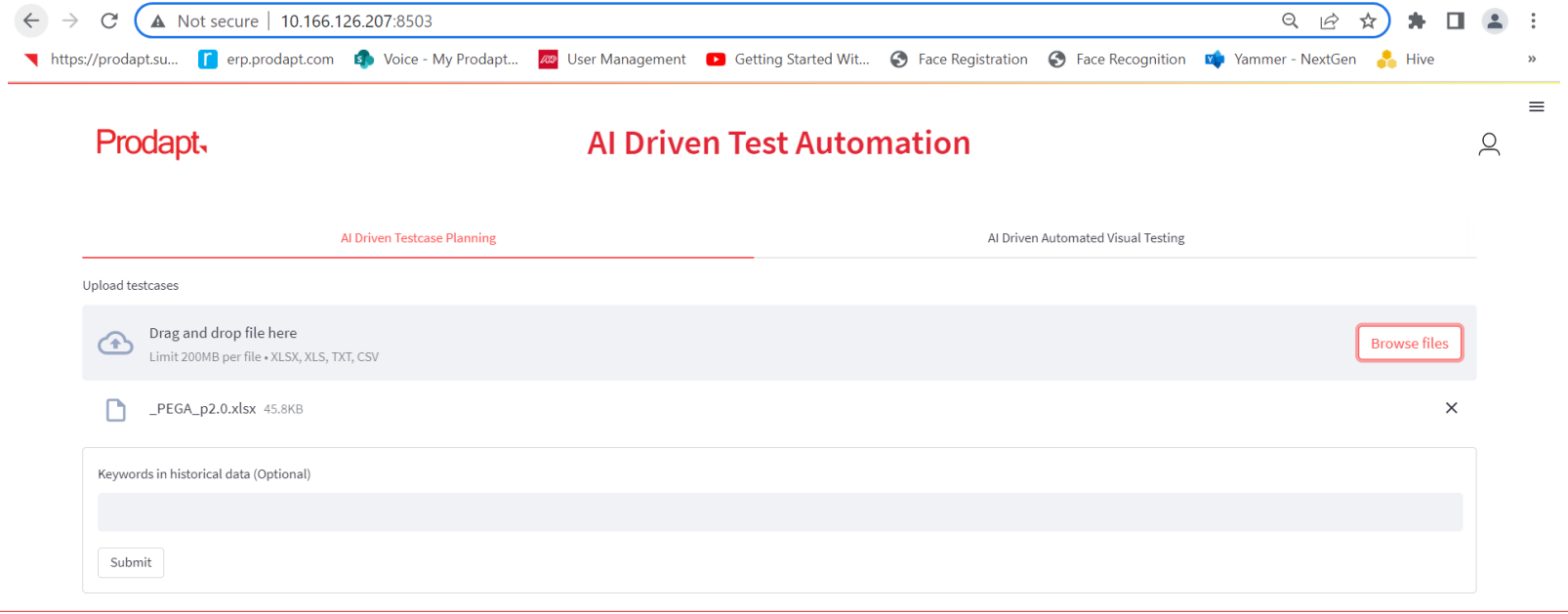
Manual vs. automated visual testing of UI dashboard

The process of visual testing is performed on thousands of test cases for each component. Some of the components included in this testing scenario are, 'Profile-change password', 'Billing', and 'Cookie-settings'. The comparison of manual and AI-driven visual testing of these components is depicted below.

Sl no	Component Tested	Sample Test case name	Time taken	
			Manual Visual Testing	AI-driven automated visual testing
1	Profile-change password	Header color, profile icon displayed, text alignment, 'My profile' menus, 'Change password' field, 'Password requirement' validation, etc.	22min 15 sec	**5 min**
2	Billing	'Payment & Billing Method' sections, Pricing alignment with respect to an account, 'Current Balance' info, 'Pricing' text, etc.	27 min 10 sec	**6 min**
3	Cookie-settings	Header color, Font style/format, Icons displayed, text alignment, etc.	5 min	**1 min**
Total time taken			~ 1 hour	~ 10 -12 min

Similarly, the testing process that is planned and executed for weeks, can be completed in hours, with Ai-driven automated visual testing, thus enabling rapid detection of visual bugs.

NLP-powered Visual Test Case Prioritization and Human Expert Recommendation: Upload Test Cases



The list of test cases to conduct visual testing is uploaded for AI to come up with **test case prioritization and human expert recommendations.** Optionally, a keyword to search in historical test cases can be supplied for NLP-powered recommendations.

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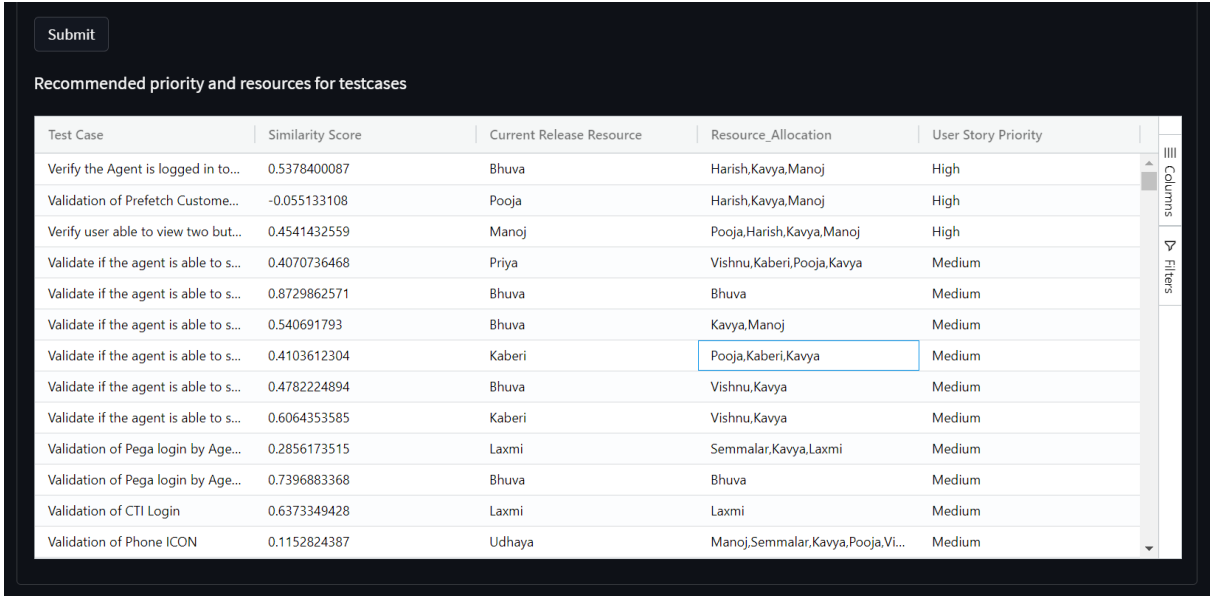
NLP powered Visual Test Case Prioritization and Visual Testing Expert Recommendation: Obtain and Export Recommendations



Test Case	Similarity Score	Current Release Resource	Resource_Allocation	User Story Priority
Verify the Agent is logged in to...	0.5378400087	Bhuva	Harish,Kavya,Manoj	High
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Validation of Phone ICON	0.1152824387	Udhaya	Manoj,Semmalar,Kavya,Pooja,Vi...	Medium

Upon NLP-powered processing of current as well as historical test cases, human expert recommendations for each current test case can be obtained. These recommendations can be exported for further reference.

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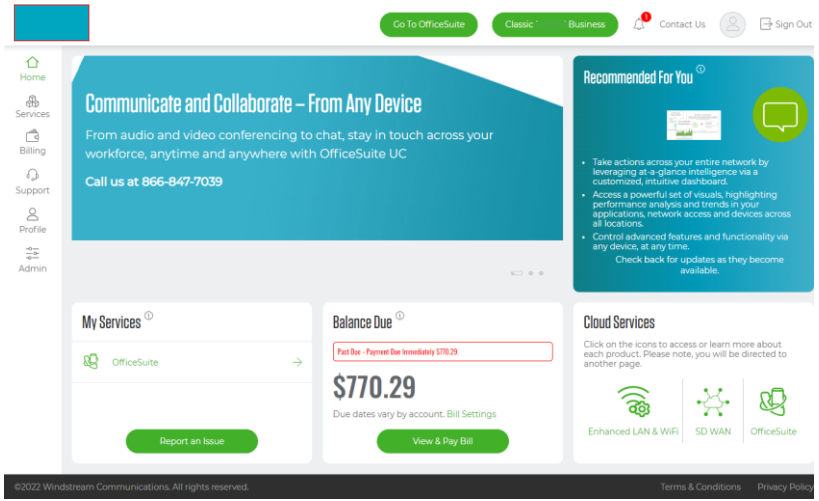
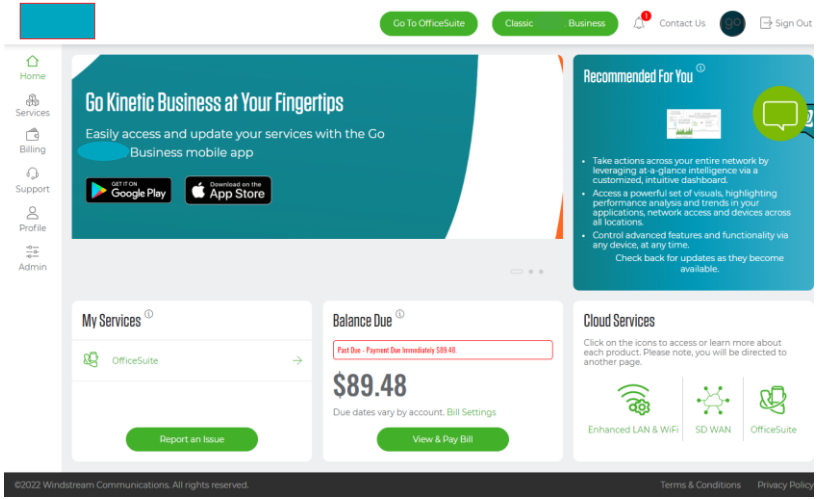
CV powered Visual Test Case Execution: Upload Design and UI for Visual Testing



Sample UI Design



Sample UI

Once the test cases are prioritized, automated visual testing can be carried out. The images of the UI design and UI in production are fed as input for CV-powered Visual test case execution.

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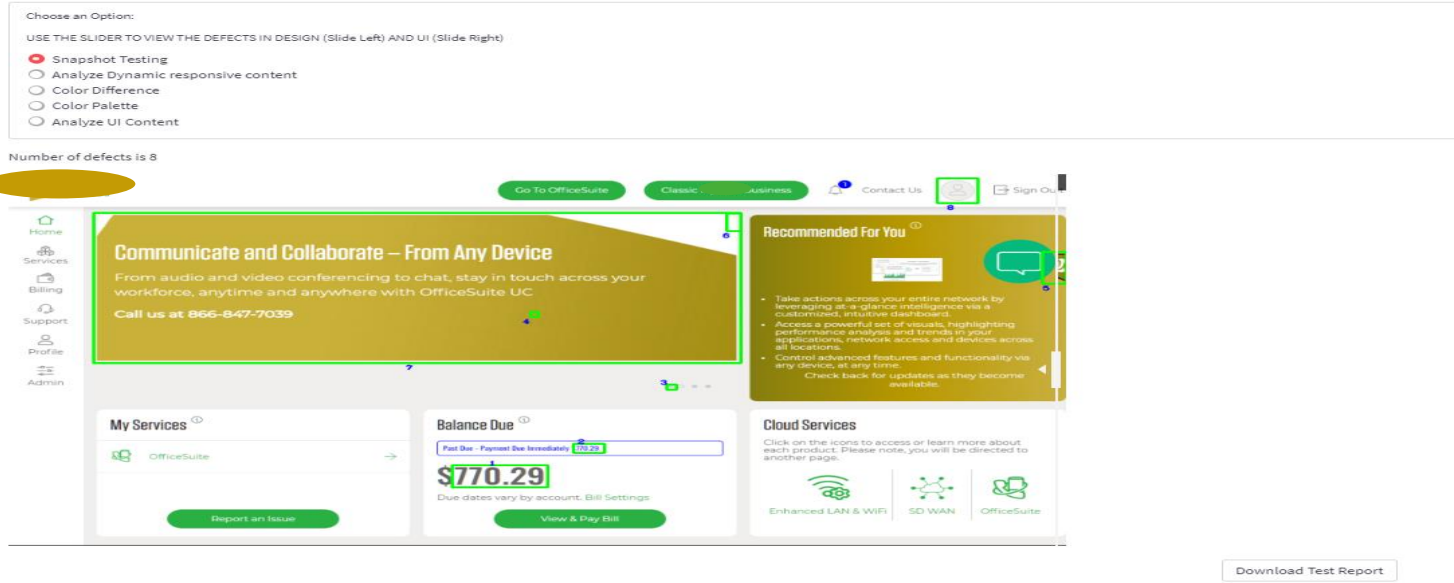
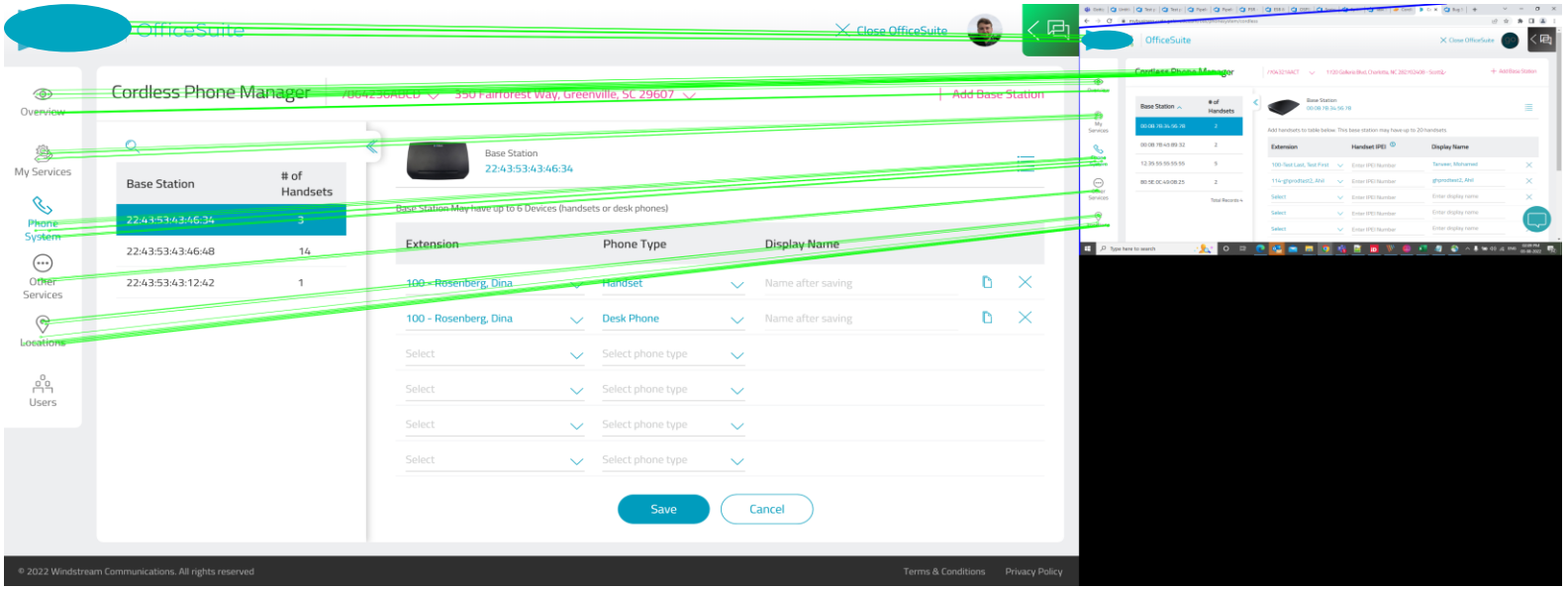
CV powered Visual Test Case Execution: Upload Design and UI for Visual Testing



For a strict comparison between design and UI, snapshot testing is chosen. It carries out a pixel-to-pixel comparison between design and UI for identifying every minute visual bug.

CV powered Visual Test Case Execution: Analyze Dynamic Responsive Content



It can be observed from the above image that UI components in the design are not affected by noises in the UI screenshot, such as taskbar, browser tabs, etc., regardless of their positions in the UI.

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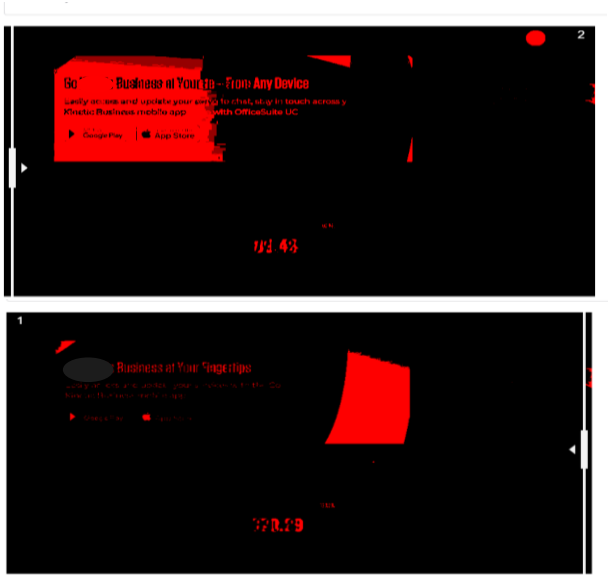
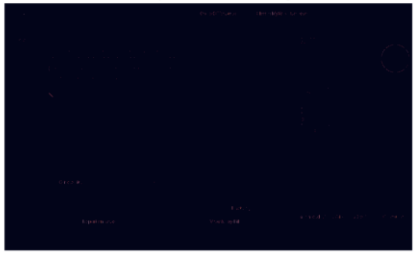
CV powered Visual Test Case Execution: UI color Summarizer



1st top color in the image

2nd top color in the image

3rd top color in the image

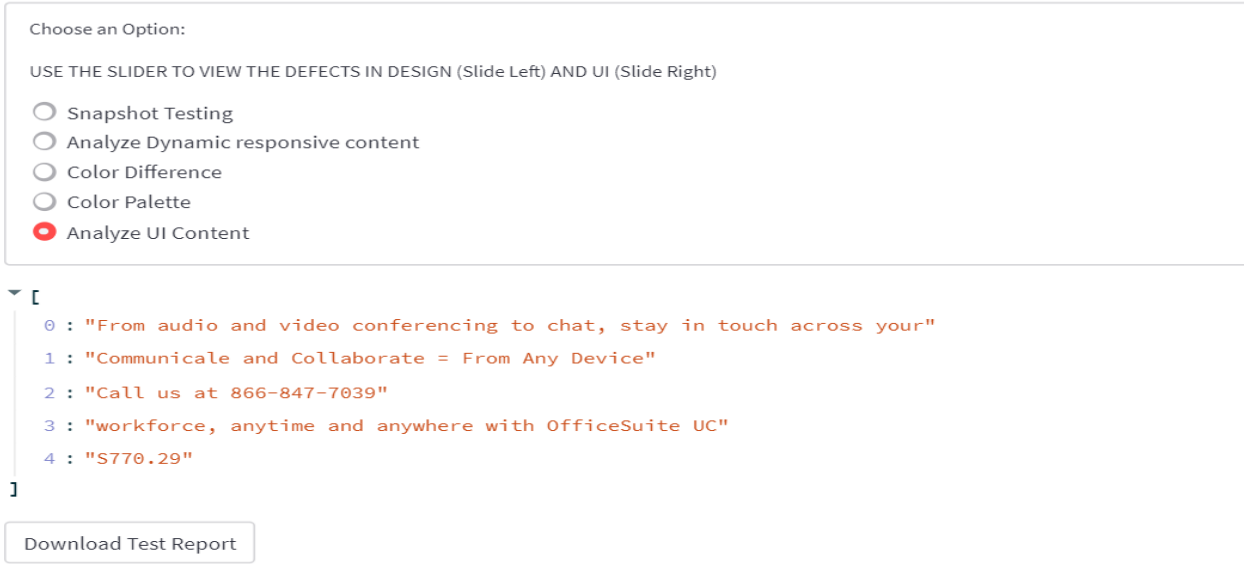


Color Palette

Analysis on the differences in terms of color between the UI design and the actual UI is done. This includes:

- Portions of images with highlighted color difference
- Top 3 colors used in the images
- Find the occurrences of the top colors in the images

CV powered Visual Test Case Execution: Analyze UI Content



Analysis is done on the UI content difference between the UI in production and UI design, for obtaining awareness on various contents such as ad content, news content, user submissions, etc.