

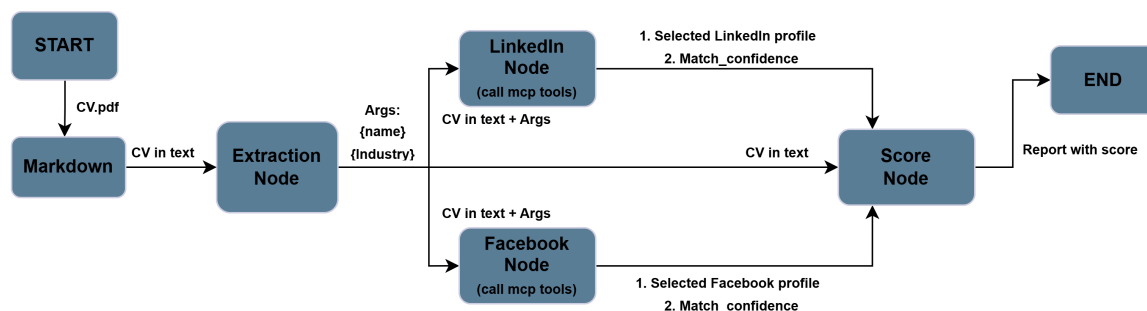
HW2-Part 1 – Multi-Agent CV Verification System

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1. System Architecture and Design Decisions

This project implements a deterministic multi-agent CV verification system using **LangGraph** as the orchestration framework. The system evaluates the reliability of a CV by cross-checking it against LinkedIn and Facebook data retrieved through MCP tools.

The architecture follows a fixed state-machine workflow:



Each stage updates a shared structured state containing:

- `cv_text`
- `extracted_info`
- `linkedin_data`
- `facebook_data`
- `discrepancies`
- `final_score`

LangGraph was selected because it enforces explicit state transitions between nodes. Every agent reads from and writes to a clearly defined state, ensuring transparency, reproducibility, and interpretability. This prevents hidden memory effects and uncontrolled tool-calling loops, which is particularly important in a grading environment.

The scoring logic is centralized in the final node. Identity resolution is handled separately in LinkedIn and Facebook agents, while reliability judgment is performed only after all contextual evidence is collected. This modular separation improves clarity and reduces hallucinated reasoning.

2. Agent Workflow and Tool Usage Strategy

The system consists of three verification agents (Extraction, LinkedIn, Facebook) and one final Scoring agent.

Extraction Agent

The extraction node parses the CV and retrieves only the candidate's name and primary industry from the headline in the CV. The design intentionally limits extracted fields to those strictly required for identity resolution. This improves retrieval precision and narrows LinkedIn and Facebook search results.

LinkedIn Agent (Primary Identity Source)

The LinkedIn node retrieves up to five candidate profiles using MCP tools (`search_linkedin_people` and `get_linkedin_profile`), expands full profile data, and performs identity resolution.

Identity similarity is determined strictly through explicit overlap of structured attributes such as university, company, city, and employment timeline. A `match_confidence` level (high, moderate, low) is assigned based on the number and strength of these overlaps.

LinkedIn is treated as the primary verification source because of its structured professional data. Later scoring logic prioritizes LinkedIn evidence when determining reliability.

Facebook Agent (Secondary Identity Source)

The Facebook node performs a similar retrieval and selection process using MCP tools (`search_facebook_people` and `get_facebook_profile`) but applies stricter confidence rules due to sparse and informal data.

Only explicit school or company matches qualify as strong anchors. Generic overlaps such as degree level or location alone are considered weak signals. If no explicit school or company match exists, high confidence cannot be assigned.

Importantly, Facebook discrepancies cannot independently trigger a Red Flag during scoring. This prevents unfair penalization caused by noisy social data.

Scoring Agent

The scoring node evaluates the CV using three discrepancy categories:

- INTERNAL inconsistencies within the CV
- MISSING EVIDENCE (claims not verified externally)
- CONFLICT (explicit contradictions)


A CONFLICT label can only be assigned when the corresponding profile has **high match confidence**.

Severity levels are classified as Minor, Moderate, or Red Flag. A Red Flag is triggered only in cases of extreme internal impossibility (e.g., overlapping full-time roles) or major conflicts with a high-confidence LinkedIn profile on core claims such as degree, company, title, or timeline.

The final reliability score is assigned on a 0–1 scale based on these structured rules.

3. Sample Verification Results

Below are the final results generated by the system.

 **File: CV_1.pdf**

 **Score: 0.85**

 **Report:**

The CV for John Smith demonstrates a high degree of reliability, primarily supported by strong corroboration from the LinkedIn profile. The LinkedIn data, with a high match confidence, aligns perfectly with the CV's claims regarding employment at ByteDance as an Engineer from 2020 to present, and education at McGill University with a BSc in Marketing, graduating in 2009. While the Facebook profile, with moderate match confidence, lists a different current employer and title (Scientist at Traveloka), this is classified as missing evidence rather than a direct conflict due to the lower confidence level of the Facebook match. No internal inconsistencies were found within the CV. The overall consistency with the primary verification source leads to a high confidence score.

 **File: CV_2.pdf**

 **Score: 0.95**

 **Report:**

The CV for Minh Pham demonstrates strong internal consistency with no apparent timeline overlaps or illogical claims. Verification against external sources reveals a high degree of corroboration from LinkedIn, which has a 'high' match confidence. LinkedIn perfectly aligns with the CV's stated professional experience at BCG and Tencent, as well as the educational background from The University of Hong Kong, including consistent timelines. While Facebook, with a 'moderate' match confidence, presents minor conflicts regarding the stated education (Master's vs. BSc) and current employment (Engineer at Manulife vs. Manager at BCG), these discrepancies are considered minor due to the strong corroboration from the high-confidence LinkedIn profile. The overall reliability of the CV is very high, supported by primary external evidence.

 **File: CV_3.pdf**

 **Score: 0.92**

 **Report:**

The CV for Wei Zhang demonstrates a high degree of reliability, primarily supported by strong alignment with the LinkedIn profile. LinkedIn, with high match confidence, corroborates the professional experience at PwC as an Engineer from 2013 to present, and the education details including a BSc in Consulting from the University of Tokyo, graduating in 2015. Minor discrepancies were noted with the Facebook profile, which listed Munich as the hometown instead of Sydney as stated in the CV, and provided less specific education details. Overall, the core professional and educational claims are well-verified, leading to a high confidence score.

 **File: CV_4.pdf**

 **Score: 0.35**

 **Report:**

The verification process revealed significant discrepancies, leading to a low confidence score. While the LinkedIn profile had a high match confidence and confirmed the candidate's name, headline, and key affiliations like Tsinghua University and Microsoft, several critical issues emerged. The CV presents a red flag with two full-time roles, Senior Engineer at Microsoft and Consultant at StartupXYZ, overlapping for three years without explanation. Furthermore, the StartupXYZ role is entirely absent from the high-confidence LinkedIn profile, and there's a two-year conflict in the PhD completion date. Minor conflicts were noted regarding job titles and specific dates on LinkedIn, and the low-confidence Facebook profile showed expected minor inconsistencies. These substantial issues indicate a low level of trustworthiness for the CV.

 **File: CV_5.pdf**

 **Score: 0.35**

 **Report:**

The verification process revealed significant and critical discrepancies, leading to a low confidence score. While the LinkedIn profile had a high match confidence and confirmed the candidate's name, education institution, and several employers, there were fundamental conflicts. Internally, the CV presents an impossible scenario of two concurrent "Current" full-time roles at EY and DataForge. Furthermore, the LinkedIn profile explicitly contradicts the CV's claimed PhD degree, listing an MSc, and shows a vastly different start date for the current EY role. Several other roles and their timelines also show notable inconsistencies or are entirely unverified. These major issues severely undermine the trustworthiness of the CV, placing it in the untrustworthy category.

4. Conculution

This project implements a structured multi-agent CV verification system using LangGraph for deterministic orchestration and transparent state management. By separating identity resolution from reliability scoring, the system ensures interpretable and consistent decision-making. In the provided test cases, the approach achieved **100% accuracy** with stable and reproducible results.